

# SUPPLEMENT.



# The Mining Journal, RAILWAY AND COMMERCIAL GAZETTE:

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## Original Correspondence.

### CUTTING AND DRILLING BY SAND-JETS.

The necessity of driving tunnels, drift-ways, and other borings through hard rocks has always greatly added to the expense and risk of mining and many other engineering operations, in bygone times, indeed, sometimes interposing difficulties supposed to be insuperable. Recent great works, such as the Hoosac Tunnel (now in course of construction) on the new railway line between the Hudson River and Boston, and the lately-opened Mont Cenis Tunnel, have proved that the inventive skill of engineers has not yet been pushed to its limits, but that appropriate machinery, as it were, springs forth in direct proportion, and answer to the necessity for its use. In the present state of the invention we are about to describe it is, of course, impossible to say to what extent the sand-jet, which may be almost considered as a new mechanical agent, can compete with the vendors' machines already in active operation; but, from the results it has already achieved, we may fairly commend it to the attention of our readers as an agent which, under very many circumstances, would be facile of application, easily adapted to the particular conditions of the work required, and inexpensive. The discovery and utilisation of opaque crystallised carbon, in place of the expensive transparent diamond, being cheap and, perhaps, equally as durable, has done very much to promote the various industries requiring the cutting and carving, in an accurate yet expeditious and economical manner, of such substances as stone, glass, or hard metals; but the present invention, if it only fulfils its present promises, has but to solve the mechanical conditions of its employment—the adaptation of the sand-boring machines to the special uses required of them to become a power in the hands of the mining engineer, which will increase manifold the production of many of our most hardy wrought mines. The invention was first introduced to public notice at the meeting of the Franklin Institute, Feb. 15, 1871, by Dr. W. H. Wahl, the resident secretary. It is the result of the most persevering experiments of Mr. B. C. Tilghman, of Philadelphia. In the discussion which followed, the rapid erosion of window-glass exposed to wind-driven sand was noticed; and when we consider the many provisions that engineers have to make against the cutting effects of a continued stream of moving particles, our astonishment at the results achieved is materially lessened. Mr. Tilghman's attention seems first to have been directed to cutting stone, or hard metal, by a jet of sand impelled by steam escaping at high pressure. His early experiments, indeed, were with high pressure steam; but, as he progressed in the knowledge of results obtainable with various velocities, he developed many uses of this process when the sand was impelled by only very moderate air-blasts. Thus, for grinding glass he uses a common rotary-fan, 30 in. in diameter, making about 1500 revolutions per minute. This produces a blast of air of the pressure of 4 in. of water, through a vertical tube 2 ft. high, by 60 in. long, and 1 in. wide. Into the top of this tube the sand is fed, and falling into the air-current, and acquiring velocity from it, is dashed down against the sheets of glass, which are slowly moved across, about 1 in. below the end of the tube: 10 to 15 seconds exposure completely grinds, or de-polishes, the surface of ordinary window-glass, so that sheets of glass on endless bands may be passed under this sand-shower at the rate of 5 in. per minute. By an ingenious arrangement of elevators the spent sand is re-conveyed to the upper hopper, and the dust made by the sand-blast, which would otherwise prove a great source of annoyance to the workman, is drawn back into the fan, passing thence with the wind into the blast tun, and again doing its work on the glass. Substances possessing any elasticity, however fragile they may be, seem to present far more resistance to the pulverising power of the sand-jet than do hard and brittle ones; hence, by covering parts of the glass surface by stencil-plates, or patterns made of paper, lace, caoutchouc, oil paint, green leaves, &c., designs of any kind may be engraved. This, by the way. For those uses of the new invention with which we are more immediately concerned, Mr. Tilghman uses steam of 100 lbs. pressure and upwards as the impelling jet, since he finds that the higher the pressure the greater the velocity imparted to the sand, and, consequently, the more rapid is its cutting action. When using the steam-blast the sand is introduced into it by a central iron tube, about 3-16ths in. bore, the steam issuing from an annular passage surrounding the sand-tube. A certain amount of vacuum is thus produced by the steam-current, which draws the sand through the central iron tube into the steam jet. The mixed air, steam, and sand then pass through a wider tube, 6 in. long, in which the steam imparts velocity to the particles of sand, and carries them forward to the stone to be operated on, which is placed at about 1 in. distant from the end of the tube. At the spot struck a red light is frequently visible, creating the impression that the stone is red-hot, but, in reality, its temperature is rather below than above 212° Fahr. This light is probably caused by the disintegration of the crystals of sand and stone. In order to produce the greatest cutting effect, free escape must be allowed for the spent sand and steam, as, if the hole made by the impact is but slightly greater in diameter than the bore of the jet, the rebound of the steam and sand forms a cushion, which greatly mars the efficiency of the operation. Under favourable conditions, when using steam equal to 1½-horse power, at a pressure of 125 lbs., this jet can cut through 1½ cubic inches of granite, 3 cubic inches of marble, or 10 cubic inches of red sandstone per minute, converting this quantity of rock into an almost impalpable powder. The appliances of the machine are as yet far from perfect, but by means of flexible or jointed connecting tubes the blast is made movable in any direction, so that it is under very considerable control; but as yet nothing appears to have been done to enable the jets to be used at any great distance from the boiler or other source of power, so that it can only be used for tunnelling or such like purposes, when the whole of the drilling machinery can be brought quite up to the face of the work operated on, in full tunnel width. But it appears to us as quite feasible that, as air can be conveyed at so high a pressure as 65 lbs. 10,000 or 15,000 ft. for the propulsion of the drills now in use, it might also be conveyed in a similar manner to Tilghman's jets, when the absence of gearing and other mechanical aids would give the new mode of drilling great advantages in the way of handiness, &c.; but these points we throw out merely as suggestions. The facts are as we have stated them, and to these we may add two more examples of the wonderful power that is thus evolved from continuous impact of small particles. With a

steam-jet of 300 lbs. pressure a hole 1½ in. diameter was cut through a piece of corundum 1½ in. thick in 25 minutes, a result truly remarkable, when we consider that corundum is but little inferior to the diamond in hardness. A sand-jet driven by 100 lbs. steam cut a hole 1 in. long and ½ in. wide through a hard steel file ½ in. thick in 10 minutes. As a curious experiment, a 50-lbs. steam-jet was fed with lead shot, and a piece of quartz subjected to it. In a very short time the shot, without being themselves perceptibly flattened, wore a small indentation in the harder substance.

### MECHANICAL PUDDLING.

SIR.—This class of puddling seems to have fallen completely into abeyance, no solution as yet suggested having given the desired effect. I pointed out when these puddlers were tested at the Downais Works that their construction was not based upon practical principles, and that any departure from the well-known physical laws as regards the oxidising of fluid iron must terminate in the same fruitless manner as these machines have invariably done. In my endeavours to discover how a really good machine could be produced I could find nothing more reliable or practicable than the present construction of puddling-furnace.

The first question that presented itself for solution was the number of superficial feet such furnace contained, including brickwork, bottom, &c.—that is, the interior from the end of the grate to the flue. Next, the time occupied by the operative in rendering the iron malleable of all shades of quality and quantity. And next the depth of bottom, which is a very important question as regards the production of both quantity and quality, for it is well understood that the same depth of bottom will not correspond with all shades and varieties of pig-iron; indeed, this part of the question seems to be the rock that has hitherto impeded the progress to the desired goal, as it is a well-established comprehensive fact that the amount of carbon that both the iron and coal contains must be the criterion, or guide, as to the depth at which the bottom should be placed. Again, there are scarcely two places where iron is manufactured that the pig-iron contains the same elements, hence it requires different treatment and different modes or modifications of the puddling-furnace.

The same must hold good as regards the structure and sections of puddling machines, as the depth of bottom is the test of the amount of oxygen the iron requires. Some years ago an officer at Cwm Avon, not feeling satisfied with the structure of the furnaces under his management, visited Staffordshire in order to obtain some better section, if possible. The furnaces this gentleman saw in operation in Staffordshire were no doubt built to suit both the coal and iron of the district; these he seems to have closely copied, and had their model imported into Cwm Avon, though a greater mistake could not be made, and this is not a solitary instance of the sad want of originality on the part of those entrusted with the management of works in South Wales. They likewise pay too little attention to the compounds and mechanical action of their irons whilst under the operation of puddling. As to the general desire to educate the working classes, I am quite sure that, so far as regards my humble self, the little knowledge I have displayed has been a source of much annoyance and trouble to me, for merely finding fault with parties high in power, for complaining that I was not content to waste my employers' property wholesale, and that I shut my eyes and opened my mouth in expectation that something good would be poured down my throat. Thousands of our best and most competent working men have already left the land of their birth, rather than be contaminated by the loose and unreasonable methods and habits that so frequently beset them, in consequence of the irrational mode that many of those managers endeavour to carry on their operations in; and I should infer that all the efforts made to educate the working man will fall a long way short of the anticipations of not a few, if there is not some encouragement afforded him to develop his gleanings and meditations; education of this stamp will prove a cruel mockery and a sham.

But to return to the requisite depth of the bottom of the puddling-furnace, it plainly must follow that, in order that the crude iron should become oxidised and, consequently purely malleable, all such machines should closely assimilate the whole structure of the present puddling-furnace, for it is quite evident that if the free oxygen that floats with the flame could be made to reach the iron with the same effect as is the case with the puddling-furnace at present, a reliable stamp of wrought-iron could be produced. The machines tested at Downais were cast-formed, this form being taken so that a more portable lump of iron would be the result. The consequence of this is, that the power and effects of the oxygen exhibited in the present mode of rendering cast-iron wrought are entirely neutralised. Another essential point as regards the bottom seems to have escaped consideration: in consequence of the oxygen not reaching the lowest part of these machines, the top only of the mass, as it revolved with the machine, became oxidised, the partial oxidation forming a coating so obstinately persistent that the middle of the mass, however many revolutions it might be submitted to, would still be crude iron, so it was evident the oxidation commenced in the wrong place, for the middle, of course, should be first oxidised. If this arrangement could be effected it would be a correct physical law, but this could not possibly take place in such a confined space as was allotted to the crude iron in the machines that have already been tested. Another point to be considered is the rate at which these machines should be driven—how many revolutions per minute—in order to complete the operation for each respective charge. How long does the puddler occupy at present in giving his iron the required change? There are some irons that the operative cannot be too expert in changing the position of the mass from one end of the furnace to the other, or it will become oxidised more rapidly than he cares for. Other species again, require more time to become oxidised, that however expeditious the operator may prove himself it will avail him nothing; this, as I said before, is mostly due to the amount of carbon sought to be eliminated from the iron for the various commercial requirements. But the most important point to be gained is to first oxidise the centre of the mass; this point gained, the revolutions of the machine acting on the mass would speedily effect all that was desired.

Now, my proposition is that a machine should be constructed exactly similar to the present puddling-furnace, and that the same shall have a motive-power to turn it only half a revolution. The charge of iron would be placed on the bottom as at present, and in order to melt it the bottom could be set at any angle, so there would be sufficient space for the iron as it became partly fused to run from one side to

the other, and thus become partly oxidised without setting the machine in any motion at all, and as the iron becomes more and more fused the machine could be set in motion, and I believe that the half-circle movement would sufficiently oxidise the crude iron. But then it might be enquired how are we to obtain a manageable and portable mass or lump? It will be at once recollected that by giving the machine the same section as the puddling-furnace, and at last giving the machine a complete revolution, the roof would give a portable form to the now completed mass. Furthermore, I contemplate that what might be called the bottom might be preserved with many species of iron as it is at present, but if the mass of wrought-iron can be made to leave the machine in some manageable and workable shape without giving the machine more than a mere rocking motion it would still enhance the economy, for instead of removing the machine from its position, in order to extract the finished ball, it could be removed through the roof. In short, reasoning from analogy, I conclude that lining could be almost dispensed with, so that the whole cost attendant upon the same would not exceed that now expended, as setting, in renovating the sides and ends of the present puddling-furnaces. Of course, the machine must be fixed with the bottom the same distance from the fire-bridge as at present, as there would be no door or fire-plate to decide the depth.

I trust even from this imperfect sketch that any ironmaster can appreciate my suggestions, and overcome any mechanical difficulty that may arise in the adoption of the machines; and I am sanguine that I could overcome almost any physical difficulty as regards the amount of free oxygen I could induce to act on the crude iron. If further details be desired I should feel most happy to supply them, according to the best of my abilities. The oxidation of almost every species of iron is still a problem requiring solution. Chemistry and machinery have made many rapid strides of late; it is no longer a question what are the elements in almost any known substance in either the vegetable or mineral world, but surrounded as we are daily by the most beautiful and elaborate designs of machinery working like watch-work, and chemistry developing its atoms, its grains, and its subdivisions of elementary matter, the ironworker in the conversion of his iron is left in a broad and trackless desert without either compass or guide to follow other than is afforded by his own rude imagination.

BENJAMIN ROGERS.

Cross Sand-street, Downais, Oct. 17.

### COLLIERY EXPLOSIONS, AND OUTBURSTS OF GAS.

SIR.—I do not remember ever having seen any collected and tabulated evidence respecting the system of working coal in those collieries and districts where explosions have been most frequent, as against those in which they have been more rare in their occurrence. It has, indeed, been repeatedly said that Northumberland and Durham (and the annual reports of the Inspectors bear out the assertion) are more free from calamitous explosions than most other districts; and the reason generally assigned for this is the double-shift principle. It has often occurred to me that it would be valuable, as tabulated evidence, if we knew what has been the system of working adopted in all the collieries in which explosions have happened during the past 20 years (say), whether it has been "pillar and stall," "long wall," "bord and pillar," or what other different system has been followed in the different collieries which have been the scene of explosions.

It not unfrequently happens that the real causes of those sad calamities are never evolved at the inquests, and the coroner and jury are quite unable to pronounce upon the contributing circumstances which have brought about the explosion under investigation; and so complete occasionally is the destruction wrought that no survivor remains in the locality of the occurrence to render any evidence towards the elucidation of the cause of the calamity.

The "long wall" system of working is that best adapted for a simple and effective ventilation of the working faces of the collieries, as it admits of the currents of air being taken around in their strength, and with the least drag from friction; but there is another view of this subject which I do not remember having seen touched upon—what effect has it upon sudden outbursts of gas, in comparison with the other methods of working coal? It is well known that with "long wall" working there is a more general subsidence of the roof than with the other methods, for after the workings have advanced some considerable distance the roof subsides over large areas at the same time—perhaps for 100 yards in length and 50 yards in breadth; and that with grinding and crushing of the gobs or pack walls, and with a great noise much akin to thunder in the overlying strata, when the ground is splitting and breaking to allow of the subsidence upon the gobs and waste. The thickness of ground that actually subsides will vary very much in different collieries, and will depend upon the strength of the ground, lines of parting between the beds, &c.; but if there is an indurated bed of rock, or a vein of coal near, it will probably subside from that bed or vein. The subsidence will probably reach an extent of from 12 to 15 inches in a few days, before the roof rests quietly upon the gobs, and this subsidence will, therefore, produce a huge cavity, stretching over a large expanse of newly excavated ground. Into this cavity will doubtless rush a vast quantity of carburetted hydrogen gas from the superior, the inferior, and the solid ground in front; and so far as the joints opened in the roof will admit of it the laws of the diffusion of gases will operate, and a portion of this explosive gas will exude through the joints, and a portion of the air of ventilation will ascend through the same joints, and in time permeate the chamber above.

Here, then, will be a great magazine of explosive gas lying along over the very points where the greater number of men are employed, and only awaiting some favourable propelling cause to come out and imperil the lives of the whole of the men in the district; and this will be the case even while the most perfect ventilation may obtain throughout the working faces below. The very same causes will sometimes operate to produce an outburst of gas from the floor of the mine if the nature of the ground favours "pucking" of the floor more than a subsidence of the roof.

What, then, may become a propelling cause, or motive-power, which would operate to force out into the workings the great magazines of destructive agency lying quiescent overhead? There are two causes, as it appears to me, which will be almost certain to contribute with more or less certainty to this result—1. A subsidence or fall into this cavity of some portion of the overlying strata which may have become weakened by the removal of its support; and, 2. That the ripping and blasting of the top in the roadways—rendered



necessary by the subsidence of the roof upon the gob—by the use of gunpowder, will frequently (if not generally) have a tendency to force out the explosive gas upon the men at work; for occasionally the holes bored will probably touch in their course, and perhaps near their end a joint that will have a more or less direct communication with the cavity above; and, if so, it is almost certain that some of the expansive energy of the explosive will be expended through this joint, for it is well known that in blowing down or blasting a "jointy" rock the greatest care is necessary to so place the bore-holes that the joints shall be avoided, or else the whole force, or nearly so, may expend itself through the joints, and the block of stone sought to be dislodged will remain intact and unmoved; and if the conditions hereinbefore supposed really existed the certain effect of blasting such a roof must be to force out a portion more or less of this body of gas from the cavity above; and thus may be brought about calamities such as some of those which have been investigated within a comparatively recent period.

That such chambers must exist over large areas frequently, or even generally, seems almost certain in those collieries where the coal is worked on the "long wall" system, and they must necessarily be a source of danger. How, then, it may be asked, can the danger be lessened? It occurs to me that holes should be bored up through the roof into the chambers at certain intervals, so that this gas may be drained off, and perhaps an exhausting pump used to clear them, or to try the air contained in them, would be very beneficial as a means of safety, the gas being "tried" or tested as it leaves the pump to ascertain its qualities.

Trefores, Pontypridd, Oct. 16.

WM. LINTERN,  
Mining Engineer, &c.

#### ORE DRESSING MACHINERY—No. XIII.

BRUNN'S COARSE-SAND JIGGER.—At some of the lead and zinc mines worked by the Vieille Montagne Company, and at mines in Spain under the management of Mr. Spowith, the jigger shown in Figs. 1 and 2 is successfully employed:—

Fig. 1.

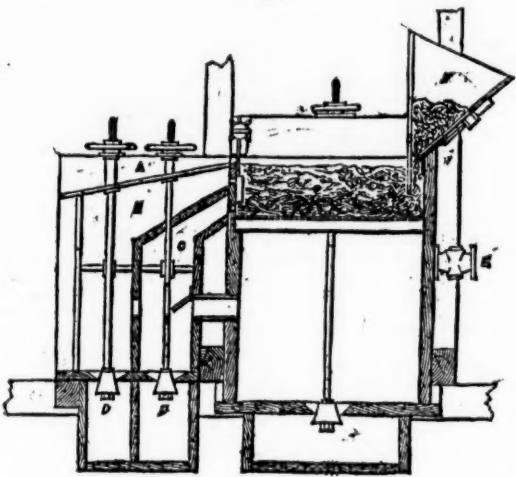
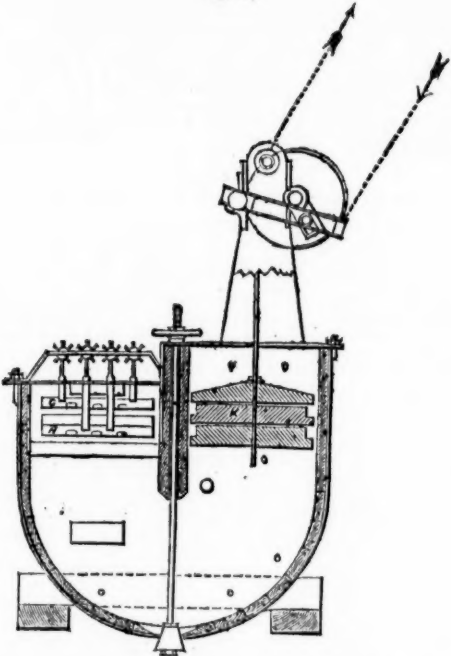


Fig. 2.



The sized sand from the hopper (F) is, by the effect of piston movement and flowing water, progressed across the plate, during which operation a separation of grains occurs, according to their respective densities. Clean ore being at the bottom passes through the holes (H) of the lower regulator into the receptacle (C), and from thence is withdrawn by opening the conical valve (D). Mixed, or "dredge," ore, overlying the stratum of clean ore, escapes through the openings (C) of the upper regulator into an outer chamber (B), and is drawn off by means of the second valve (D). The "waste," or sterile, sand is delivered into a launder (A), forming a roof to the second chamber; consequently, on one sieve a triple division of the original stuff is effected. The piston (K) is worked by Kley's gear, which gives a downward rate of movement greater than that of the upward half of the stroke, and also allows of the lengthening of the stroke from zero to 5 or 6 in. The cock for admitting a constant flow of water is shown at E. The length of sieve is 28 in., width 19 in., depth of sand on sieve from 6 to 8 in.

JOHN DARLINGTON,

Colman-street-buildings, Oct. 17.

#### THE CANADIAN SHORE OF LAKE SUPERIOR.

SIR,—The North Shore silver discovery has attracted a great deal of attention this summer. Most of the old Lake Superior copper explorers have been over, and many have located and bought up lands reported immensely valuable. Sales have been made since in some instances of a tenth of the land taken up, and enough realised therefrom to more than cover the whole outlay.

On Silver Islet mining work is being carried forward, the depth attained being about 85 ft. The vein maintains its size, and for a given length its richness. It is almost impossible to conceive how rich some of the rock taken out is. I have several pounds of it which is worth 75 per cent for silver. From reliable sources I gather that since the commencement of operations the company have taken out not less than \$1,000,000 worth of silver.

It is natural to expect that a great many speculations will be offered to the public, many of them worthless, and it seems to be an established fact that there is on the Canadian shore of Lake Superior a great mining country. I have recently conversed with a miner (a Cornishman whom I have been acquainted with for five years) who has spent two years in exploring that coast and the adjoining

country; he reports finding no less than 15 large and well-defined veins, some of them carrying native silver, but so far as seen, with one exception, not rich. The exception referred to is in the hands of other parties. Nearly all the veins carry silver-lead, some of them in large quantities. He reports that his explorations were conducted on a coast line of 40 miles above Silver Islet.

The veins of the country run into the lake, and can be found by tracing the shore, so that the explorations need not be carried on to find the veins. When a vein is found it can be run on inland into congeal strata, and as most of the lands are in the hands of the Dominion Government, favourable localities can be obtained at Government prices.

A capital of 4000Z. (or \$20,000), judiciously spent, would be ample to explore and locate what, in all probability, would prove good mines. It seems to me that any company of mining men would prefer spending a small amount, as above stated, in exploring a rich country, and obtaining a selection of lands at Government figures, to paying enormous sums for mines, simply because they are in Nevada, and in the hands of speculators.—Michigan, Sept. 21.

MINER.

#### SOUTH AFRICAN DIAMOND FIELDS.

SIR,—So little apparently is known in connection with these fields, and opinions are so diversified, that any direct information on them from impartial sources may prove acceptable, not the less so from being from one of your own craft. Having left Natal on May 24, in search of health and information, and travelled 225 miles north of this district, along the Vaal, visiting all the fields by the way, no opportunity of gaining knowledge has been allowed to escape. By the time they are ended and I return to Natal my travels will have been 1300 miles by land, and 450 miles by sea. The whole could have been completed in two months, slow from a European point of view, but it will denote what existing facilities are, and these are likely to improve.

This is written from within a stone's throw of the spot on which stands the veritable house (Van Wyk's) said to have been plastered with diamonds, a paragraph about which went the round of the home and colonial Press not long ago. Two small stones were, there is no doubt, picked out of the plaster on the outer wall,—a thing not to be wondered at, seeing that this farm and the two adjoining ones have proved the richest yet known. The Bultfontein diggings about almost on to those of Dutoitspau, De Beer's, the third, being distant two miles only. All three, in fact, are adjacent each to the other, and on them are congregated about 15,000 whites (men, women, and children), with their native servants. Nearly all live under canvas; many in their wagons, which are commodious and answer all the purposes of eating and sleeping rooms. Stores and hotels are built of iron alone, or wood with iron roofs, and, being numerous, the whole forms a curious and interesting sight as seen in the bright sunlight. There is nothing else like it in South Africa, if in the world. Certainly nothing like it exists anywhere connected with the search for diamonds. These diggings are far removed from any river, the work being confined to dry siftings. At first diamonds were obtained on and immediately below the surface. At present they are found largely to a depth of 16 feet, or even more. This morning a stone of 124 carats has been unearthed—probably not worth more, however, on the spot than 2000Z., being of very irregular shape.

The other diggings are all within carting distance of water, nearly all on the Vaal River, which will be found on the maps as forming a junction with the Orange River in about lat. 29°05' N., long. 24°10' E., all on soil claimed by the Free State and South African Republics. In all some seventeen river spots have been worked, with varying success, but are all being gradually deserted for the neighbourhood of Dutoitspau, where the work is much lighter. You merely mark out a claim 30 feet square, and, after loosening it with pick and shovel, bucket out the stuff, sifting and sorting on the claim. At the river the stony nature of the ground entails greater manual exertion, and at Pniel large boulders have to be displaced. Besides which, you have either to cart the water from the river to the claim, or the diamondiferous stuff to the river. I will not occupy your valuable space by entering upon the geology and interesting formation of these fields, the more so as Mr. Tobin, of the London Polytechnic, who recently left this place, will on his return enlighten the public thereon. He has with him what some take to be a specimen of the diamond in its matrix—as yet, however, a moot point.

What more interests the general reader is whether diamond digging will pay, and the readiest mode of getting to the fields. I purpose giving a few particular facts, leaving the reader to draw his own conclusions. First, then, as to prospects. My own conclusion is that as yet any one without means to take him home again in the event of failure ought not to come here. Not but that there are diamonds sufficient, for I believe, judging from personal observation, there are fields still undeveloped that will afford work for any number of years to come, and that diamond digging will before long become an established industry, as gold digging is in Australia and California. But, unlike gold, diamond digging is a huge lottery. To one prize there are many blanks. This it renders the occupation less generally attractive, and accounts for so few entering into it compared with the other. In gold digging, once on a given field a man can reasonably anticipate that a day's work will yield an average day's pay. Not so here. At the same time, a diamond digger, working steadily on, stands a very good chance of being successful in the long run, exceptions (many though they be) to the contrary notwithstanding. One case, that of three brothers of my acquaintance, working separately, but in close proximity to one another, will best illustrate what I wish to convey. One, the youngest, yet, if anything, the most persevering of the three, who never had less than five natives working under his direction, realised but 12Z. worth of diamonds; the other two nearly 2000Z. each, all having had 12 months' steady work. Within the last few days, however, the youngster's luck would appear to have changed for the better. He has had a good find or two. Many there are, I am bound to state, who after 12 months' labour have got but little by it. Some of these—not, however, all—for obvious reasons, would fail in any undertaking they entered into with their present leanings. A man of unsteady habits, or unable to "rough it," ought to be the last to come here. Above all, no one should be persuaded to throw up remunerative occupation of any kind, especially if permanent. One who is robust and can afford it, persevering, seeking occupation, or determined on trying to better himself elsewhere, may fairly take his chance. If he fails of success he will, at all events, have enjoyed a pleasant cruise in other respects. The thorough change will do his health no harm (quite the reverse in my own case, for I am as strong again as when I left home), and if his head only be screwed on the right way he cannot fail to gain valuable experience, and all at a moderate outlay. Just now those who have exhausted their own resources, can, if of good character, obtain employment, tools, and food, together with a fair share in the finds they may individually make. Men coming here require to have their bump of determination fairly developed, and parties of two, three, or not exceeding four are found to work best together. At present native labour is not very reliable, but, such as it is, may occasionally be picked up at 20s. to 30s. and rations per month. Some few favoured new comers, *via* Natal, there obtained Zulus—by far the pick of the native tribes—to accompany them.

Living at the fields is by no means out of the way. Breadmeal varies from 25s. to 45s. per 180 lbs. (13d. to 3d. per lb.), English money and weight, according to the season. Beef and mutton of prime quality are brought round to our tent (at De Beer's, by far the pleasantest of the camps, to my fancy) daily, the price being 3d. per lb. In fact, most necessities, whether in food or clothing, are in good supply, and obtained at reasonable cost. The hotels and boarding-houses only charge 20s. to 25s. per week, exclusive, of course, of liquors. The scarcity of water in this dry season is the great drawback. Sunday is the only day on which tubbing is general. It is not altogether the price, 3d. per bucket, but the distance water has to be fetched which, if you have no native, is the difficulty. One party with more money than energy is credited with having tried a bath of soda water. I do not, however, vouch for it as a fact, though I think it very likely to be a true bill. Vegetables are scarce and dear.

Both light and heavier clothing are required, the summer (the rainy season) being as hot as the winter (or dry season, more appropriately) is cold. It is now the dry season, and the days are pleasantly warm. Once the sun is down the air is often intensely cold.

Boisterous winds put a stop to all outdoor work for several hours occasionally. Nor do we find some indoor work—writing in one's tent, for instance—at such times the pleasantest occupation in life. Nor, after the rains and heat set in, or, say, between November and March, can the sojourn be so pleasant as now. Fever and dysentery sometimes occur then. Still people hang on to the work all the year round. This shows, at any rate, that it has something fascinating about it. The life is necessarily a rough one at the best, and although several lady acquaintances of mine vow they enjoy it, others, fresh from Europe especially, must be prepared to find everything utterly unlike home.

The question as to routes must stand over until my arrival on the coast, when I shall be enabled to speak of them from further actual experience. In the interim allow me to remain

R. VAUSE,

Dutoitspau, July 21.

P.S.—Having changed my plans since the above accounts for being the bearer of my own letter thus far. Later reports are confirmatory to what precedes, large finds continuing to be made daily. Just as I embarked at Cape Town on September 5, my friend Mr. Ross showed me advices he had that day received of a diamond 98 carats, one 50 carats, and several small ones having been found in the Victoria district, about 100 miles from Hope Town, on the Orange River. This being in the Cape colony proper largely extends the line on which diamonds exist. These are the first finds worth mentioning that have been reported so far down as the Orange River. My son, writing from De Beer's, reports a new rush there the day after I left, which has yielded handsomely.

Having promised a report on routes to the fields, I may state that from Natal I went by a private omnibus (light spring wagon), with a team of eight mules and horses, to Bloemfontein, capital of the Orange Free State Republic, 397 miles, in 11 days, including two days' rest by the way. Such a conveyance, however, was quite exceptional, ox-wagons being as yet the ordinary mode of travelling. There are hotels most of the way—in Natal every few miles. From Bloemfontein to Dutoitspau (104 miles) I proceeded by post cart in 26 hours. From Durban to the fields, direct about 480 miles, by ox-wagon, ordinarily occupies, with the grass in fair order, about three weeks; fare, 5Z. and upwards, according to the requirements of the traveller. Between Durban and Maritzburg, 54 miles, two four-horse omnibuses run daily. In light travelling order you may buy or hire a horse and ride to Harriemith (153 miles from Maritzburg), and there take post-cart for the fields; total distance about 500 miles, which would occupy at present ten days. It is more laborious, the carts travelling night and day. The time stated allows for two days' detention at Bloemfontein. Though slower, ox-wagon travelling is easier. You enjoy the fine scenery and have good sport all the way, game of all kinds being abundant. The wagon is your home on the road. From the fields I returned to Port Elizabeth (Algoa Bay), about 480 miles, by passenger-cart, which is a covered conveyance drawn by four horses; through fare 14Z. 15s. The usual time occupied is seven days, but owing to the wretched condition of the horses we were 13 days on the road. They are now, however, again performing the journey in half that time. The scenery on this line is also fine; the Katberg Pass (6000 feet) magnificent. There are hotels and sleeping accommodation all the way.

There is another route by the Transport Company's light spring wagons and eight horses or mules running weekly between Cape Town and the fields (650 miles to Pniel), fare 12Z. 12s., which occupies seven to nine days, according to the weather. The scenery is exceedingly diversified, and there are hotels and sleeping accommodation the whole way. A mule wagon (without springs) also runs weekly between Cape Town and the fields, occupying from 14 to 21 days, fare 9Z. To those by steamer from England, with whom time and creature comforts are a consideration, Cape Town, of the three routes, unmistakably offers the greatest facilities. After that Port Elizabeth (Algoa Bay). To others, studying economy, who desire a healthy trip, and are fond of a variety of scenery and good sport, Natal will, undoubtedly, commend itself. Sailing vessels from London to Durban, thence by the mode above indicated, will fully meet their requirements, especially where the conveyance of baggage is an object. All the fares quoted are, of course, exclusive of food. Mr. Cobb, the originator of the Australian and New Zealand coaching traffic, when I left Cape Town, was on his way to the fields, with a view to starting stage coaches. He had not decided on the best route, but efforts were being made to induce him to try Natal as well as the Cape. The coaches had already reached Algoa Bay. A post-cart, at any rate, is talked of between Maritzburg and Harriemith, which would be the forerunner of a conveyance right through at any rate.

It will give me pleasure if, before returning, I can afford any other information. Letters can be addressed to me, 30, Cornhill, London.

#### THE UTAH MINING COMPANY.

SIR,—I have to-day noticed two letters on the above company in the Journal of Sept. 9. The first is a report by Mr. Henry Altman; the second is one signed in ambush, and with initials only, and, no doubt, has its particular object, which I have not time to fathom, but carries with it an amount of exaggeration which if believed in by the general public, which I much doubt, would bring about a reaction which could only cause a panic. Interested as I am in the success of this property, having been selected as umpire to decide between Captain J. Nancarrow and Mr. H. Janin, I wish the shareholders not to be misled by any exaggerated statements, but to prepare themselves for doing justice to the property by comprehending its real merits, and the manner in which this fine property can be made to pay handsome dividends. Mr. Altman's report throughout does justice to the property; but he allows his better judgment to run away with him in stating—"If within twelve months from this date that property does not prove to be worth ten times the value paid for it, I am no judge." I have inspected the Utah Company's property several times, and recently in my last trip to Salt Lake (this month, September). The principle on which this property should be worked in order to produce dividends is a very simple one, and, until I see it carried out, I shall myself personally not feel much confidence in such.

Great masses of low grade ore require to be worked on a very large scale, and to effect this the working capital should be in proportion—and that of the Utah Company is too puny for such a vast undertaking. I pointed this out to one of the directors of the company a few days after forwarding my report to London. No notice of my letter was taken, and, therefore, I am bound to vindicate myself publicly, that until an adequate working capital is provided I shall myself have no faith in forthcoming dividends. I agree with one portion of Mr. Altman's report, that if this company were to pay attention to their gold ledges the results would be most satisfactory. When the secretary of the company, Mr. P. A. Eagle, arrived in Salt Lake City a fortnight since I pointed out to him the importance of looking into the manipulation of the gold ores on the Utah Company's ledges; but as these ores in general contain little or no lead and a great deal of quartz matrix they cannot be worked in the furnaces, but must be milled separately. Undoubtedly, some of the lead ores contain fabulous amounts of gold, but the greater bulk contains too much gangue to be thrown in with the lead ores.

I forward you a certificate of some of the assays which I had made by Mr. J. B. Meader:—

June 19.—I have carefully assayed the six samples of ore you left with me, and find them to contain—  
Mark "Olive," 63 per cent. of lead; 98.22 ozs. of silver to the ton of 2000 lbs., value \$121.41; 0.43 ozs. of gold, \$8.88. Total value gold and silver, \$130.29.  
"No. 0," 55.5 per cent. of lead; 11.66 ozs. of silver to the ton of 2000 lbs., value \$15.08; 0.1 oz. of gold, \$2.06. Total value of gold and silver, \$17.14.  
"No. 00," nothing but a trace of gold and silver.  
"No. 000," 31.5 per cent. of lead; 14.98 ozs. of silver to the ton of 2000 lbs., value \$18.85; no gold.  
"No. 0000," 56.05 per cent. of lead; 200.8 ozs. of silver to the ton of 2000 lbs., value \$259.56; 175.39 ozs. of gold, \$3625.81. Total gold and silver, \$3885.37.  
"No. 00000," 56.06 per cent. of lead; 23.32 ozs. of silver to the ton of 2000 lbs., value \$30.16; also trace of gold.—J. B. MEADER, Salt Lake City.

I again repeat that, with an adequate working capital and a metallurgist at the works, I have not the least doubt as to future dividends. Mr. P. A. Eagle, the secretary, having resided in Australia for some years, and well versed in gold operations, will be a most valuable addition in assisting to carry out any trials as to the milling of the gold ores on the company's ledges.

The large furnace now on point of completion, which will smelt



70 tons daily, is undoubtedly a great step towards the foundation of future dividends; but four such furnaces must be built on the works. This is also other operations wanted at the mines require adequate working capital, in order not to hamper the manager's operations. At present he is in the predicament of a mule out camping with its master, a lasso round the neck, and can only grass at a short distance from the stake—forced to contract his operations to the length of the rope imposed on him by the Utah Company.

HENRY SEWELL,  
Pacific Mining Company, Austin, Nevada, Sept. 28.

#### MINING IN COLORADO.

SIR,—Enclosed I beg to send you the names of the principal gold mines in the Central City Mining District, which are as follows:—

The Gregory lode, which has been worked on about 4000 ft. in length, and is owned by eleven different companies; the deepest shaft is about 400 feet. The Bobtail lode, about 800 ft. in length, and is owned by five different companies, some owning as little as 33 ft. 4 in., and 66 ft. 8 in., making 100 ft. between them. This is considered the richest mine in Colorado, the lode in the bottom of the shaft yielding over \$300 per ton in gold, which is nearly 500 ft. below the surface from the top of the mountain. The bottom of this mine is now under water, as is also the Gregory, in consequence of the pumping machinery on the Bobtail being insufficient to keep the water out of that mine. It has flooded all the mines on the Gregory also, and although the water is but small in the mine the parties interested cannot be brought together to put up the proper machinery to do so. Some of the small proprietors having realised handsome fortunes are independent, and not willing to subscribe their portion *pro rata* to have the necessary machinery—nor will they sell their property to others, unless they have a double value for it, thus, being a kind of a dog in the manger, will not work it themselves or let other people do so, unless to their benefit—consequently, all these rich mines are now idle, and I fear it will be some time before they will be resumed unless some good company get hold of all the property, and put up proper machinery to keep the water, and work the mines effectively. The small holders, Sir, in the mines of Colorado are a great drawback to mining, as you or anyone else can see, and I would advise all English companies who invest their money in that country to see that they have a sufficient length of ground, not less than from 2500 to 3000 ft. in length on the course of the lodes, in order to keep others from working these mines at other people's expense.

The Mammoth is a continuation of the Gregory and Bobtail lodes west, both lodes having formed a junction in the east part of this set. This mine is about 3000 ft. in length, and is owned by six different companies. The shafts are nearly 400 ft. deep. This is a good property if properly worked, the lode being large and well defined, and yielding a high percentage of copper, besides the gold. In consequence of the suspension of the Bobtail this mine is also idle. The Gunnell is situated about half-a-mile south-west of the before-named lodes, and has been worked about 1200 ft. in length, and to the depth of about 300 feet. It is now full of water, in consequence of the different holders refusing to subscribe their proportion according to their holding to put up the necessary machinery for pumping. This mine is also rich in the bottom, and would leave great profits if properly worked.

The Ophir Mine is situated near the town of Nevada, about 1 mile west of Central City, and has been worked in length about 3000 ft., and to the depth of nearly 500 feet. It is owned by eleven different companies, some owning 30 ft., some 40 ft., and some 50 ft. and upwards. Most of these claims are in full work, and returning good profits, and would yield much larger profits if the different classes of ore were properly selected. Adjoining this lode to the south is the Kansas, which is a large and regular vein, being worked for more than a mile in length by different parties, and is in most places very rich so far as yet opened on; but in general the ground is by far too short for profitable working, and I fear when they get to water the same unpleasantness will arise as in the mines before named.

The other lodes in this district are the American Flag, Gardner, Alps, Illinois, Topeka, and California, Kent County, and many others that are of not so much importance, and are being worked by a few men only. The California is the deepest mine in the district, the main shaft being nearly 700 ft. deep. For the last 100 ft. sinking the lode has been small and poor as compared with the ground above, and I fear it will take another 100 ft. before it is again in good pay. These mines have been very badly worked indeed, and are now being leased to miners, who are paying the companies 25 per cent. of the gross proceeds, and making the mines pay well. Some have made great fortunes out of the mines that the agents could not make pay through their neglect and want of judgment.

St. Austell, Oct. 12.

H. B. GROSE.

#### THE MINING BUREAU OF THE PACIFIC COAST.

SIR,—We had a very excellent and brilliant Convention, the proceedings of which are enclosed, and are well worthy the attention of your readers. Our Bureau, thanks to your kind support and that of the *Times*, has become a strong and honourable institution on the coast. All country papers and practical miners are in its favour, as it will immensely benefit California, and save large amounts of foreign capital. There is no longer a chance for the "Wild Cat," and the time has arrived to redeem the good faith of the Pacific Coast, and to develop seriously their *bona fide* mining resources.

I also enclose an excellent leader from the *Record*, every word of which is honest and true. The reign of Wild Cat King is, indeed, at an end.—San Francisco, Sept. 27.

CORRESPONDENT.

The following are extracts from the proceedings at the Convention:—A preliminary meeting was held at the Golden Eagle Hotel, Sacramento, on Sept. 20, for the purpose of discussing the action of the Mining Bureau of the Pacific Coast for the past year. Governor L. B. Bradley, of the State of Nevada; State Senator William Minnis, of Yolo County; Hon. William Neely Johnson, late United States Register of the Land Office; Mr. R. J. Stevens, Mr. J. G. Sevens, Mr. Jeremiah S. Brown; Mr. Edward Muller, of Nevada County; Mr. A. A. Neithercott, of Placer County; Mr. M. G. Griffith, of El Dorado County; Mr. L. B. Harris, Deputy Secretary of State; Col. J. Berton, Vice-Consul of France; Mr. E. P. Hutchins, of Butte County; Mr. Samuel H. Sheppard, Mr. Samuel Davis; Mr. Chas. H. Frier, of Oroville, and many other persons were present.

In his report the secretary said that—The board has held numerous meetings since its organisation both in San Francisco and Sacramento. Application has often been made to the secretary to learn if the Bureau would be willing to purchase the valuable property, and the Bureau does not undertake the sale of any mining property whatever, nor can it do so without violating the original design of the first Convention and purposes of the Bureau. But parties having meritorious *bona fide* mining property for sale will receive such valuable information as the Bureau is able to give them whenever their property is registered in the books of the Bureau. The board of directors will also order and procure a thorough examination and report upon any mining property registered in the Bureau whenever application is made to that effect.

"On the motion of Mr. M. G. Griffith, the secretary was instructed to cast the entire vote of the Convention for the present board, consisting of Col. J. Berton, Vice-Consul of France; Hon. G. Fisher, Royal Consul of Greece; Mr. Robert Hanly, Col. Harry Linden, Mr. E. P. Hutchins, and Mr. A. F. Williams.

"The Convention then took up the question of the propriety of appointing one or more commissioners to visit London, for the purpose of organising a corresponding Mining Bureau at that point, with the object of facilitating the operations of the Mining Bureau on this coast. On the motion of Mr. B. F. Hunt, it was resolved that the board of directors are hereby authorised to take such measures in the premises as they in their judgment may deem proper. The Hon. E. O. F. Hastings, Mr. Doolittle (of Nevada County), Mr. Wm. Neely Johnson, and Judge Landrum addressed the Convention, expressing their hearty co-operation and desire to see the organisation a success.

"The secretary submitted copies of the London *Times*, containing editorial articles commending the Mining Bureau to the favourable consideration of capitalists in Europe. Copies of the London *Mining Journal*, endorsing the organisation of the Mining Bureau, were also submitted by the secretary. The reading of these articles produced a marked effect upon the members of the Convention.

"On the motion of Mr. E. P. Hutchins, the thanks of the Convention, as well as the board of directors, are hereby tendered to the press of Sacramento City, the press of the Interior counties, the London *Times*, and the London *Mining Journal* for their numerous acts of kindness and support extended towards the organisation for the past year."

THE PACIFIC MINING BUREAU.—We published yesterday a full report of the Annual Convention of the Pacific Coast Mining Bureau. This organisation has now been in existence long enough to demonstrate the feasibility of the ends for the carrying out of which it was instituted, and we think it may be said that its vitality and usefulness are fully established by the success which has crowned its efforts, in spite of a bitter and uncompromising opposition. Those who are acquainted with the condition of our mining business at the time it was inaugurated must be aware that it required no common courage and perseverance to urge forward such a system of reform in face of the organised op-

position which existed. For many years the business of buying and selling mines had been in the hands of men who, if not adventurers in the fullest sense of that term, had become so callous by constant association with demoralising agencies as to retain few scruples as to the manner of procuring their acquisition. The more daring of these men had frequently formed combinations to effect the sale of bogus or worthless, mines to foreign capitalists, and, caring nothing for the effect to be produced by this line of conduct, had created in every foreign money market strong and well-grounded suspicions of the genuineness of California mining enterprises. It had at last come to this, that while our mineral regions languished for the want of foreign capital, or any capital, to develop them it was a hopeless undertaking to place any claims, however genuine they might be, upon the money markets of Europe. The crisis was a serious one, and at this juncture certain thoughtful and energetic men determined to make an effort to restore to the mines of the Pacific Coast the reputation which a long series of dishonest speculations had deprived them of. Hence the origin of the Mining Bureau. The intention of its founders was to establish an agency which should be entitled to the respect and confidence of foreign capitalists, and which should pass upon such mines as might be offered for sale, thus affording to the intending purchaser a trustworthy guarantee as to the real standing of the property placed in the market.

As a matter of course this movement was strenuously opposed by a larger and deeply interested class. The brokers' eliques in San Francisco did their best to ridicule and pooh pooh it. Efforts were made to pack the Convention of January last, and one little sheet in the interest of the brokers first sought to obtain a controlling influence in the meeting, and, being foiled, had recourse to that kind of abuse which is only safe because the calumniator is not worth accusation. The more daring of these men had frequently formed combinations to effect the sale of bogus or worthless, mines to foreign capitalists, and, caring nothing for the effect to be produced by this line of conduct, had created in every foreign money market strong and well-grounded suspicions of the genuineness of California mining enterprises. It had at last come to this, that while our mineral regions languished for the want of foreign capital, or any capital, to develop them it was a hopeless undertaking to place any claims, however genuine they might be, upon the money markets of Europe. The crisis was a serious one, and at this juncture certain thoughtful and energetic men determined to make an effort to restore to the mines of the Pacific Coast the reputation which a long series of dishonest speculations had deprived them of. Hence the origin of the Mining Bureau. The intention of its founders was to establish an agency which should be entitled to the respect and confidence of foreign capitalists, and which should pass upon such mines as might be offered for sale, thus affording to the intending purchaser a trustworthy guarantee as to the real standing of the property placed in the market.

The Bureau has, within the past six months, effected the sale on very advantageous terms, of several valuable mines in this State, and in no instance has there been any distant or slighted sale, or any fact which would reflect upon its reputation. It is now firmly established, and it is a power in the land, in spite of all the efforts of its opponents. They commenced by attempting to laugh it down. They next sought to ignore it. And now they are compelled to realise that it is so very substantial and solid a fact that unless they determine to do business on a strictly honourable basis they may just as well throw up their employment altogether. We take an honest pride in our share of what has been accomplished. The *Record* was the first to recognise the importance of the Mining Bureau, and has supported it through good and evil report, until now it is able to stand alone, and need ask no odds from anyone. We are thoroughly satisfied that its institution will be most beneficial to this coast, as indeed it has already been, on a limited scale. It has put a stop to a system of knavery and swindling which disgraced California; and it has opened the door through which hereafter the idle millions of European capitalists will flow to enrich and develop our mineral resources.—*Sacramento Record*.

#### HOME AND FOREIGN MINING.

SIR,—There can be no doubt but that the judgment of men is frequently warped by the feelings, and those again by prominent personal interests. This creates a greater disparity of opinion amongst them than could possibly arise from mere intellectual differences. The light of the mind, when unaffected by prejudice, is like the light of the sun, direct in expression from its source, and, like it, composed of many rays, which may be bent, contorted, or reflected by certain media, or decomposed, according to the nature of the substance against which it may impinge, or through which it may pass. But, unlike the sun, the light of the mind is derived from various external sources, through the medium of the senses, in individual rays, which rays are disposed or dispersed according to the temper, texture, and constitution of the mind itself, which always acts as a reflector, a medium, or both. It is, therefore, conceivable why the same thing may be seen by different individuals at the same time under widely different aspects. We see through lenses somewhat accommodating to our feelings and wishes, which enlarge the objects and gild the prospect in the field of view in which our interests lie. The mass of mankind are—at least, with apparent sincerity—divided upon matters affecting their interests, easy of solution to impartial observers. The course of one man's thoughts can scarcely coincide with that of any other, because the motives by which they are actuated are antagonistic to each other.

Home and foreign mining constitutes an extensive field of observation, and much may be said in favour of each, without reflecting on the other. Exclusiveness, it may be observed *en passant*, is equally opposed to liberality and human progress, and may be said to be the shell of which selfishness is the kernel. There are individual mines at home preferable to the generality of mines abroad, and individual mines abroad preferable to the generality of mines at home. Like all other communities of persons and things, each consists of good and bad; and not only so, but advantages may be affirmed in favour of each, and may be equally successfully offset by those claimed in favour of the other. The question—to determine the disposition of capital—I think, should not be which of the two is best, but how much of either is good.

The advantages of home mining to the individual investor is comprised principally in the cheapness of labour and material, aided by the close supervision which may be exercised in all its departments. Against this, and in favour of foreign mining, may be urged richer lodes, shallow mines, cheaper and more expeditious ground generally for working, and less water to be encountered, both as an impediment to the working and an expense in the raising thereof, besides being subject to a nominal compensation only for ground occupied or destroyed, and such compensation (5s. per acre) secures its freehold. Another advantage of foreign mining for silver and gold is the comparatively unalterable character of their value, no lamentation in respect whereof is ever heard arising from a ruinous drop in the standard, as they themselves are the standard or representatives of all other values. We are frequently reminded, through the columns of the Journal, of the fluctuations in value of our home mines from variations in the copper and tin markets, and the diminished and, in some instances, suspended dividends in consequence thereof. I mention this, not as an argument directed against home mining, but as a contingency inseparable from all mining prosecuted with any other object than the noble metals.

The wealth of England overflows itself as a field of investment, and the market, so to speak, is glutted with capital. Its finding, therefore, lucrative channels of investment elsewhere cannot diminish or prejudice home investments, but tend most assuredly to secure their support. Capital successfully employed in foreign investments is more subservient to the interests of England and the development of her resources than it could possibly be by lying dormant (or the next thing to it) at home.

I am of opinion that the past history of foreign mining should not be taken to represent the present and the future. A new era has assuredly dawned upon it, both in respect of an important extension of its area, and improved facilities for its working, arising from an extended application of the arts and sciences, as well as by a corresponding improved experience in mining engineering generally, for, whatever may be said of its past history, it has certainly kept pace in the present day with contemporary industries, although much more complicated, both in its internal and external lineaments and features, than most of them.

One of the advantages of mining in the field from whence I write is comprised in its quality and extent, and the comparatively low prices at which valuable properties may be secured by those knowing how to treat for them. I will not echo the inconsistency that mining in this part of the country can be launched and successfully carried on without the aid of capital, but I do state, with the utmost deliberation, that mine upon mine in the most easily accessible parts of the State, and led up to by good roads, may be purchased for comparatively small sums, and that when furnished with the necessary facilities for raising and reducing the ores would pay cent. per cent.

per annum upon the outlay, and, "practically speaking," without conceivable limitations as to time.

Ellsworth, Nye County, Nevada, Sept. 13.

ROBERT KNAPP.

#### PRACTICAL MINING—TRIBUTERS' ORES.

SIR,—If your correspondent, "B. S.," considers there is no inconvenience in commencing a calculation for distributing the proceeds of a parcel of copper ore containing little over 2½ tons of fine copper with an error of 3 cwt. 1 qr. 22½ lbs. of fine copper, I fear it would be extremely difficult for him to obtain any tables that would give him satisfaction, and I can now well understand why he complains of the tables of Mr. Jehu Hitchins. I feel quite sure Mr. Hitchins never contemplated a parcel of ore weighing 39½ tons, and containing over 2½ tons of fine copper, being sold at 6 per cent. ore (but, perhaps, he will speak for himself), or he would certainly have framed his tables on a different basis. It is quite a mistake to suppose that the several tributers' shares cannot be ascertained by his tables if each tributer is contented to allow the uniform rate of 2½. 15s. per ton of ore returning charges; but I think Mr. Hitchins will confirm my statement that at the present time the smelters do not, in practice, charge 2½. 15s. per ton returning charges on any ore, and he will admit that the smelters do not at present make the same returning charges upon ore of 5 per cent. and of 10 per cent. produce respectively. The fact that Mr. Hitchins estimates uniform returning charges of about 12. 7s. 6d. per ton of ore (thereby causing an unfair distribution of the proceeds of a parcel amongst tributers' ores forming a mixed parcel differ more than ½ per cent. in the produce) is the only complaint that can be made against his tables; but to make the tables work well it is, of course, necessary that the produces should be accurately known.

In the case "B. S." refers to I find that, even using the same table for variations, it makes just 1s. per unit difference to each tributer, whether we estimate that ore of 6 per cent. produce sells for 32. 7s. 6d., or that ore of 6½ per cent. produce sells for 32. 7s. 6d.; and if we take the wrong produce, and deduct poundage, the result is not the same as if we take the correct produce. Taking a couple of 10 ton parcels, of 8½ and 5½ produce respectively, they would be paid for (if 6½ per cent. ore fetches 32. 7s. 6d. per ton) at the rate of 42. 8s. 4d. for the first, and 22. 11s. 8d. for the second, so that the parcel of the 8½ ore would be worth 442. 3s. 5d., and the 5½ parcel 252. 16s. 7d.; the 20 tons being worth 702. But if we attempt to divide this 702, according to "B. S.'s" system of first calculating 1s. per unit 200 much for each produce, and then deducting poundage, we shall find that the 8½ parcel gets only about 442. 0s. 6d., and the 5½ parcel 252. 19s. 6d., so that the tributer getting the 5½ ore would receive 3s. that should properly belong to the other man, who would necessarily have to go 3s. short. The result would be about the same whether Mr. Hitchins' or any other tables were used, inasmuch as one man would receive part of the money belonging to the other; but according to the tables used the difference might be 3s. or 30s., or any other amount, according to circumstances.

I regret that I have not a copy of Mr. Hitchins' tables to refer to; but I think if "B. S." will use those tables he will find that if 39½ tons of ore, holding 236 tons of fine copper, sell for 132. 5s. 9d. (giving a standard of about 102. 1s. for 6 per cent. ore), and that if 39½ tons of ore, holding 253 tons of fine copper, sell for 132. 5s. 9d. (giving about 99. 19s. standard for 6½ produce), the difference will be somewhat as follows. But I should mention that smelters never calculate the price from the standard, but always, when they calculate the standard at all, the standard from the price:—

	Produce.	Standard.	Produce.	Standard.
1	7½	99 0 0	7½	97 0 0
2	8½	108 10 0	8½	105 0 0
3	9½	117 0 0	9½	113 0 0
4	10½	126 0 0	10½	121 0 0
5	11½	135 0 0	11½	130 0 0
6	12½	144 0 0	12½	139 0 0
Parcel	6	102 1 0	6½	99 12 0

Now, I think if "B. S." will take the second series of figures, or whatever may be the exact amounts which Mr. Hitchins' tables may give, he will find that 1s. 10½d., nearly, poundage will not be wanted. This is not difficult to understand, because I believe that Mr. Hitchins' tables show that when the standard for 6 per cent. ore is 102. 1s. the standard for 6½ per cent. should be 100. 6s. 6d., and that if 6½ per cent. ore fetch a standard of 99. 12s. a parcel of 6 per cent. ore should be worth a standard of 101. 6s. 6d.; though "B. S." seems to assume that at 99. 12s. for 6½ the standard for 6½ should be 102. 1s., the difference being equal to 10½d. per ton on 6 per cent. ore. Surely there should be greater accuracy observed in using them before Mr. Hitchins' tables are compiled of.

AVERAGE STATES.

Oct. 16.

#### "THE SCIENCE OF INVESTMENTS."

SIR,—The continued yield and prosperity of our standard mines show unmistakable evidence of the stability and permanency of mining investments when compared with joint-stock enterprises generally. Dolcoath, Cook's Kitchen, Tincroft, Carn Brea, and East Pool Mines have been at work, from time to time, over a century, and the present companies have from 30 to 40 and up to 50 years existence. Again, South Caradon has been a brilliant success of nearly 40 years continuance. Basset, Providence, Botallack, Levant, St. Ives Consols, and Lisburne range from 35 to 50 years. The Crofty, Roskears, and Kitty (St. Agnes) date from 40 to 50 years back, and many other properties can be referred to that fairly establish the hypothesis that *bona fide* mining (not gambling and market share jobbing schemes) compare well with shipping, building, trading, and almost every description of commercial pursuits. The mines in St. Agnes and Camborne, stretching west from East Dolcoath, in Illogan, on to Dolcoath, are attracting great and deserved attention as eligible mediums for the employment of capital. The continued success at Kitty, and the enhanced value of the lodes as depth is attained, have thoroughly dissipated the conviction of the "old school of miners" that minerals would only be found in shallow deposits. The facts now prove the contrary, and practical authorities concur, and express their opinions openly, that the mines in this once celebrated district are at present only in their infancy. New Charlotte is an example; Old Towan, Penhalls, and Wheal Charlotte would unquestionably prove valuable mines for tin if re-worked; whilst East Dolcoath, on the west, has yielded 700000. worth of tin from the backs of the adit level and the old burrows since the works were abandoned by the former company. This property has passed into the hands of a London firm, and the works are likely to be prosecuted with spirit, skill, and practical expenditure. Time is money in mining, hence rapid development under judicious supervision is fully half the battle of success. Defeat is too often attributable to the absence of energy and funds. The mineral production of the world is second only to agriculture in importance and value to the human family. The products of the earth are as essential to the prosperity and advancement of society, both socially and politically, as the yield of the soil is indispensable to the sustenance and well being of creative life. The existence is known and the use of metals is utilised throughout every clime, and amongst every people. They are the "staple" of our manufactures, and the "accessories" to our arts and sciences; whilst agriculture constitutes the "substance" of God's provision for all animal creation, the sustenance of living nature, and the fruition and necessary—nay, indispensable—requirements and wealth of every tribe and race of inhabitants on the face of the earth.

The produce of gold and silver of all countries in the civilised world is estimated at 40,000,000. sterling annually, but that of other metals and minerals, such as iron, copper, tin, lead, &c., with coal and earths, are doubtless more than 200,000,000. sterling, of which Great Britain and Ireland contribute fully 40,000,000. as its quota; a sum equal to the whole productions of the precious metals from every country and under every clime. In value, iron and coal are first in quantity and importance as regards both wealth and utility, and are found in immense quantities throughout many parts of England, Scotland, and Ireland; constituting the medium of employment to vast numbers of the working classes, and enriching the industrious and enterprising, who direct their energies and capital to the production of the hidden wealth. Tin is almost entirely restricted to Cornwall and the west of Devonshire; copper is found in Cornwall, Devon, Cumberland, Anglesea, Staffordshire, Scotland, and Ireland, and also in many other parts of Great Britain. Lead is dispersed by nature more generally throughout North and South



Wales, Scotland, Ireland, and many parts of England, than any other metal, excepting iron. Immense have been the gains that have attended the working of mines in search of all and each of these products. It would appear that England was never, as regards its metallic productions, in so conspicuous and exalted a position as at this time, for, vast as have been her yield of treasures, one discovery after another of her mineral wealth attests the fact that no approach to exhaustion is at present discernable, and, to all appearances, the large supplies of the past increase rather than diminish—the more mines that are opened, and the faster they are wrought, the greater will be the gains. I some weeks ago drew attention to mining *esprit* in the eastern district of Cornwall; and it is with satisfaction that I refer to "New Hingston" as an instance of successful subscription of capital on the London market. The shares have been applied for by men of both wealth and practical mining intelligence, many residing in the immediate neighbourhood of the property; whilst the reports of eminent authorities confirm the inherent value of the various lodes.

R. TREDINICK,  
Consulting Mining Engineer.

3, Crown-court, Threadneedle-street, London, Oct. 18.

#### A MINING TOUR IN WALES.

SIR,—I happened a few days ago to be in Carnarvonshire, and in visiting the different towns and villages dropped upon a quiet little seaport called Pwllheli, not a very handsome town, but certainly a most beautiful beach, splendour, and air quite unsurpassed. Having taken up my abode at the Crown Hotel, kept by a well-looking old gentleman called Price, I made myself quite at home. I got out of the landlord what there was to be seen in the neighbourhood. Beyond telling me of the mountains and valleys he said there were some lead mines a few miles away, worked by some London gentlemen. Being a shareholder in three or four of the rich mines in the neighbourhood of Redruth, in Cornwall, I at once ordered a trap and went away to see what I could find out in this outlandish part of the world. After about seven miles of a very decent road I arrived at a mine called Assheton, and found a very intelligent Cornishman, named Johns; he was most civil, and spent some 25 minutes with me in explaining what they were doing in those mines which comprised the Assheton and Penrhyn property. Standing on a rising slope from one of the most beautiful seas in the world, called St. Tudwell's Bay, Capt. Johns explained to me, from the top of Mawr shaft, looking west, a mine working by a gentleman called Campbell, close on the boundary of Assheton. The shaft is now sinking in a very fine lode, and some magnificent stuff had been drawn up. I should say he is almost certain to have a good mine. This looks well for a long piece of unexplored ground to the west of Brown's shaft at Assheton.

The deepest part of Assheton is 20 fms. under the adit or sea level. At the east and west lodes, of which about Mawr shaft are the deepest workings, splendid rocks of lead were being drawn from the very bottom of this shaft, some of them more than a man could lift, and almost solid. There are a large amount of workings going on in this mine, and the levels driving on the various lodes must embrace some hundreds of fathoms. There are three pumping-shafts—Lindow's, Gundry's, and Mawr, and are about 300 fms. from each other. There is a splendid engine, which pumps from the three shafts, as well as winding stuff from the mine. Capt. Johns stated that there was no doubt on his mind that Assheton would make a very profitable and lasting mine with a little more developing. We also went over the Penrhyn Mine. The resident agent here is Capt. Mark Whitford, and with Capt. Johns they explained all that was going on. The deepest part of this mine is 40 fms. under the sea level, and in sinking a very valuable lode is coming in the shaft. The agents have no doubt on their minds that Penrhyn will make a very valuable mine.

I must not forget to mention John Craze, the pitman in those mines, a fine athletic fellow, who boasts of having purchased 40 shares in Assheton Mine. He could realise a good profit, but he was going for a far greater one. All I can say is I was much pleased, and hope to pay another visit there some day.

MINING TOURIST.

#### WITH WHAT ARE THE STRATA ABOUT PRODUCTIVE COPPER LODES MINERALISED?

SIR,—With your permission, I will make a few comments on the letters of those correspondents who for the last three weeks have been giving your readers their opinions on the above question.

I much doubt if Mr. James Payne's beautiful analogy (Sept. 30) between the soil and the strata exists in nature. Doubtless the character of a lode has some relation to the strata by which it is enclosed—this is a general belief, since all mine reports speak of "congenial rock," "congenial strata," &c.—but to my mind it is exceedingly questionable if that relation is analogous to that which exists between the soil and the plant or tree which grows upon it. There appears to be a "missing link" in Mr. Payne's theory—a something not generally known to man, which plays a prominent part in the "growth" of lodes. It is to be hoped that the analyses of the strata about the six productive and six unproductive lodes, urgently called for, will lead to its discovery.

Mr. Payne's unqualified remark that "it is the working of so many unproductive lodes, from want of chemical knowledge, which has crippled mining," can scarcely be taken as the sole cause of crippled mining, I fear. If this were the case the remedy would be simple enough. Insist upon all managers of metalliferous mines knowing chemistry and chemical analysis. That a better acquaintance with chemistry is desirable in agents is illustrated by the assertion of Capt. B. Williams in the *Mining Journal* of Oct. 7—that the composition of yellow copper (yellow copper ore would be less "vague") is—copper, about 76; sulphur, 22; iron, 5. Now, if Prof. Ansted be correct, yellow copper ore, or copper pyrites, is composed of copper, 34.55; sulphur, 34.91; iron, 30.5 per cent.

"Mining Engineer" (Oct. 14), replying to Capt. Williams, says if Capt. Williams's assumption be correct, then "we might as well (according to Mr. Williams) work the strata for copper as the lode." This, I think, does not follow, since, assuming that the elements which compose the lode are to be found in the enclosing strata, they must exist in such infinitesimally small quantities, and bear such a small proportion to the containing strata, that it would never pay to work the strata.—Oct. 16.

ACROBA.

#### CORNISH MINING—MINERS' WAGES.

SIR,—In the Supplement to last week's *Journal* a correspondent intimates, amongst other things, that one of the most influential landowners in the county of Cornwall is about to insert a special covenant in all future mining leases to compel the payment of wages twice a month, instead of the present practice, &c. In the event of this principle being acted upon by landowners generally it may not, perhaps, be amiss to express a desire that they will at the same time exhibit some little consideration for another portion of the mining community—that is to say, for those who risk their capital in the development of the land; and that a clause may likewise be inserted to the effect that the lessees should be hampered as little as possible by anything bearing the semblance of unreasonable premiums of dues demanded whilst calls are being paid for the trial of their own property. Whilst on this subject it may also be well, in the interest of all who may hereafter be called upon to embark their capital in mining enterprise, to intimate to the landowners that they would confer a great boon on the public by making a point of enquiring to some little extent into the proclivities of parties who may happen to apply for mining grants; and, above all things, to avoid entertaining the applications, however plausible, of men of wide-spread doubtful reputation.—Oct. 17.

AN ANTIQUATED BAL CAPTAIN.

#### EAST LLANGYNOG LEAD MINE.

SIR,—Your correspondent of last week, signing himself "A Miner," when writing about this mine, was evidently a little moody, as it seems quite clear that he could not correctly read the agent's report which he attempts to criticise, or he may have written out of spleen against Capt. Pascoe. The present agent is managing the mine in a far more scientific, economical, and efficient manner than it has previously been managed. If, however, "A Miner's" ideas are by this time a little more settled, or his comprehension a little more clear, I will, for his satisfaction, repeat what the agent did say, which was that in driving the No. 4 level they had reached or come under the borer-hole, and

that they had commenced rising under the mine, so as the more speedily to connect one lode with the other, and thus effect a great saving in the working cost of the mine.

#### GREAT NORTH LAXEY COMPANY.

SIR.—It is to be hoped now that a competent and experienced man like Mr. Peter Watson has joined the board of directors in this company that the interests of the shareholders will be more regarded and the mine deepened more quickly, when, if such takes place, there is not the slightest doubt, according to the proved character of the neighbourhood and the success of Great Laxeley only a few fathoms deeper, of this mine turning out equal to the expectations of the shareholders, who have waited patiently enough in all conscience for the development of their property. (Even Captain Rowe acknowledges that, although, as "An Old Shareholder" says, "he does not deepen.") It certainly appears that the home thrusts given by "An Old Shareholder" are too much for the directors and manager, or we should have seen an explanation in the *Journal* before this, showing cause for the disappearance of the shareholders' money—professedly raised to deepen the mine. However, we must hope for better things in future, and, as it seems we cannot redress any other way, or compensation in future for mismanagement in the past, must trust to Mr. Peter Watson to infuse some of his well-known energy into the management, and see that the mine is properly and quickly deepened, not relying, as too many directors are apt to do, on the word of mining captains or any others whose minds may, perhaps, be fascinated by the process described in a late number of the *Journal* as "beating out for salary." I do not, of course, say such is the case here, but still we outsiders are not behind the scenes, and consequently, cannot tell what is going on, so that our only source of redress for grievance is through the *Mining Journal*. I would here say to "An Old Shareholder," stick to your shares through good and evil report, and take no notice of the "bulling" or "bearing" which may take place now that the mine is once more brought into notice. I, for one, have sufficient confidence in Mr. Peter Watson to say that he will not let grass grow under his feet. If depth is wanted, as we all believe it is, to prove the mine, he is the man to have it done, and that speedily. A SHAREHOLDER.

#### CAEGYNOG MINE.

SIR,—As a shareholder in Caegynog, I have read with much pleasure the letters published in the *Journal* from "A Tourist," and from Capt. Absalom Francis, the latter a man whose opinion on mining matters must have considerable weight. It certainly appears to me somewhat singular that the investing public who place their capital in mines should prefer the risks and uncertainties of foreign mines at enormous premiums to sound English mines at par. In the first instance, they have to trust solely and entirely to the representations of men of whom they probably know nothing concerning properties they cannot personally inspect, whereas in the case of our home mines any person can at a small cost easily satisfy himself by a personal visit whether the property is being properly developed and the capital honestly applied.

I quite agree with the remarks of your correspondent, "A Tourist," that a great future is in store for Caegynog, and I feel sure that there are few mining investments which could be selected at anything like a similar price and with so little risk as this.—Hertford, Oct. 16.

A SHAREHOLDER.

#### THE TERRAS TIN MINE.

SIR.—It appears evident to me that some of the dealers and jobbers are trying to frighten timid shareholders, of which there may be a few, who know nothing of the schemes practised in large cities. As a proof of what I mean, some ten days ago I saw one party offer 50 Terras shares at 28s. 9d., and another offered to sell at 20s. At once wrote off to both, and thought I was sure of a prize. Alas! the golden fruit I was in search of was not to be got; the 28s. 9d. share was withdrawn, and the person who offered to sell at 20s. plainly told me he wanted to buy at 20s., and heard they were to be got at that price. Now, Sir, I detest gambling, and this sort of practice will not escape my censure. If I find the same game tried again I shall be apt to name the parties. So far as I am personally concerned, it is a matter of moonshine what they offer shares for. I have some notion of the intrinsic value of the mine, and by the time I have Christmas comes round the shareholders will begin to taste the first fruits of the glorious harvest that will mature in due season. The young craft of 18 months old will soon be a stately barge, and can anyone inform me of a tin mine in Cornwall that can tell the same tale? The adventurers may well say thanks to Mr. Martin and his gallant crew for steering the tender craft through so many breakers; she is now approaching the golden harbour, crowned with honour and success.

Allow me to say one word here about Terras, and I am done with it; it will soon speak for itself. In looking over a batch of letters I saw one that read thus:—"I pity you in Terras, unless you get the shares for a song. I know Terras well, and take care of yourself. I confess I paid 60s. for a few, but 30s. was about the mark; and though their intrinsic value is far above 60s. I like to buy as cheap as possible. I trust my remarks will confirm the wavering, as by foolish advice they may lose their price; and I also hope it will deter jobbers, &c., from carrying on such a false game." A month ago I got a letter from a mining man; it was in breathless haste, and read thus:—"Buy Terras at 5s., and I will give you 10s. and not to lose a post. I do by the way. I consider that I said in a former letter, I do not take the startle so hurriedly. As a rule, the Scotch folk are thinkers, and uncommon canny in their way; and, believe me, it needs it all. But, Sir, when I got the *Mining Journal* I saw fair Lucy had been selling at 35s. to 45s.; as for Terras, I never see a sale, though I believe it is a mine.

Mining is a most legitimate commercial pursuit, and is the backbone of Great Britain's commercial greatness. But people who frequently get themselves deterred from buying in consequence of the scheming practices of parties who get up mines to sell. In looking over the statistics of mines, I know of no commercial pursuit that has yielded such returns for the capital; and though there are many blanks in mines the same remark applies to railways, banks, &c. How few railways pay dividends worth naming, and how many pay nothing at all to the original shareholders? How many banks have failed, and ruined thousands? Yet many cry down mining pursuits, because a few people have lost money; but, in consequence of the loss of a few, they throw away the good cow ploughs. My first start in mining cost me 600l., but I am determined to have it out of the bones of Terras, &c., and to run away from the battle is the trick of a coward.

J. ADDISON.

#### EBERHARDT AND AURORA MINING COMPANY.

SIR.—It is difficult to understand the violent fluctuations in the shares of the Eberhardt and Aurora Mining Company, except it be through market operations, or a want of real knowledge of the company's position and affairs. I venture, therefore, to put before your readers a brief statement of certain facts, gathered from reliable sources, which, with the deductions I propose to draw from them, will, I think, place the prospects of the company in a clearer light.

Mr. Hague, in his elaborate report on the South Aurora Mine (which adjoins the Eberhardt and Aurora Company's property), states as a "safe estimate" that the total cost of mining, hauling, and milling to the South Aurora Company is \$25 per ton. This estimate is based on the past working of the mine. Mr. Benjamin, the manager, puts the present cost to the South Aurora Company at \$23 per ton. The South Aurora Company's mill (the Stamford) is a fine steam engine, and the ore is conveyed to the mill by tramway. The Eberhardt and Aurora Company's mill (the International) is one of 60 stamps, and the ore is conveyed to the mill by tramway. I think, therefore, that the cost of mining, hauling, and milling will not exceed \$20 per ton; indeed I think that this will prove to be a high estimate. Mr. Hague, in his report, further states that the capacity of the 30-stamp mill is "from 50 to 60 tons daily." Putting the daily capacity, then, of the Eberhardt and Aurora Company (6-stamp mill at 95 tons, and adding to this the daily capacity of the Oasid Mill, of 10 stamps, the International Mill, and Aurora Company—we have a total stamping capacity of 105 tons daily.

The manager of the Eberhardt and Aurora Company (Mr. Phillipotts), whose reports have always been characterised by prudence and caution, says in his last published report, with regard to the Ward Beecher Mine—"I see my way clearly to extract ore of the average assay value of \$50 per ton sufficient to supply the International Mill for twelve months." With regard to the South Aurora Mine, he says—"I intend to put the mine in a position to develop this mine when a new engine is put in." With regard to the Eberhardt Mine, he says—"I have little doubt we shall, by-and-by, come upon a deposit which will sustain the character of the mine."

Estimating, therefore, the present reserves—36,500 tons—the (daily capacity of the International Mill is calculated at 100 tons) in the Ward Beecher Mine at \$50 per ton, and allowing \$20 per ton for mining, hauling, and milling, there remains a net profit of \$30, or 6s. per ton, giving a total net profit of \$1,050,000 for one year's working. Taking the North Aurora Mine, in which a rich strike has recently been made, and the assay value of from \$1500 to \$3000 per ton at the same value (it is confidently said to be of much greater value), we see that since the formation of the company discoveries of additional reserves have been made of the estimated net value of \$38,000l., or nearly the present market value of all the shares. This estimate may be taken as correct, seeing that it is based for the main part on Mr. Hague's report, above referred to, which report, though it bears testimony to the immense deposits in the Ward Beecher Mine, is evidently written with a bias against the district.

When it is borne in mind, therefore, that the Eberhardt and Aurora Mining Company was formed by thoroughly shrewd men of business of high integrity, upon trustworthy reports on the low-grade ores then in sight, and based their calculations of good profits only on working these low-grade ores by means of improved mechanical appliances, the immense increase in the value of the property may be judged of by the discoveries in the Ward Beecher and North Aurora Mine since the formation of the company. It must be remembered, also, that the mines have not been worked to any depth, and that the Oasid Mill of 10 stamps realised during the last winter months a net profit of from 4000l. to 5000l. per month on the high-grade ores of the Ward Beecher Mine.

In the application of the improved mechanical appliances errors of judgment have been committed. A penny-wise policy induced the directors to erect their mill with one boiler only. No important engineering firm would have done this on their own works, even in England, and it was the more necessary in mining operations far removed from facilities for effecting repairs quickly that the International Mill should have been supplied with at least one extra boiler, so that the milling operations might be continued during any necessary repairs to one or other of the boilers. Another error was in entrusting the erection of the wire-tramway to an ordinary workman, instead of to an experienced and able engineer. In consequence of this, the work has been imperfectly done, a considerable expense incurred, and the operations of the company delayed. But to infer from this that the great value of the company's property has been permanently affected is simply absurd. Mechanical difficulties such as these are easily overcome; indeed, so far as I can learn, they have, for the most part, been overcome.

As to the additional expenses incurred in these necessary repairs and alterations, it would seem to be a hardship to shareholders who bought their shares at a high premium to have their profits appropriated for the purpose; 2 per cent. debentures might be issued, and easily paid off within one year by gradual instalments, and in this way the capital of the company would not be permanently increased.—Oct. 18.

[For remainder of Original Correspondence see to-day's *Journal*.]

#### A TRIP THROUGH THE UTAH TERRITORY, U.S.

EAST CANON, OPHIR DISTRICT.

[Continued from the Supplement to the *Mining Journal* of Sept. 30.]

Near the city of Ophir the different smelting-works are all in operation day and night, and the business is a thriving one. The furnaces of Schofield, Abbey, Drake, and Co., known as the

EAST CANON SMELTING WORKS, have been running since July 10, and reduce about 10 tons of ore per day. The owners are new to the business, but have been successful thus far.

The BREVORT MILLING COMPANY, at the lower end of the East Canon, has a steam stamp mill, patented by J. W. Forbes, of La Porte, Ind., which cost \$2500 in the East. It is known as the "Automatic Steam Battery," and the mortar is oval in shape, discharging from a No. 40 screen on all sides. There are two stamps, the stems of which are 6½ ft. high, and 65 lbs. of steam are required to run them. They use two engines, one of 10 and one of 30-horse power. This mill is run on the same principle as Willson's stamp mill, so well known on this coast, the stamp-stems acting as pistons to two vertical cylinders, so that the full force of the steam is thrown directly on the stamp. This company also have five improved Varney pans, and one Farnham and Warren patent pulp grinder, with a capacity, it is said, of 1 ton per hour. The grinder is 30 in. high and 3 ft. in diameter, grinding the pulp three times over, and then discharging it into the amalgamating pans. This is a new enterprise, and I shall notice the results with interest, as anything that will reduce the price of milling is of benefit to my particular friends, the miners. A short distance from the canon is the first quartz mill of any size that was ever erected in Utah. It is known as the

WALKER BROTHERS' MILL, and is under the superintendence of Mr. L. Dunn, a well-known and practical Nevada millman. They use 15 stamps, each weighing 65 lbs., each crush day, and have a 75-horse power engine, two boilers, each 16 by 48 in. diameter, fitted with steam and mud drums, and six pans and three settlers, of Mr. Varney's improved patent. The pans are 4 ft. 8 in. diameter at the bottom, and 26 in. deep, and the mullers are the same as in the old Varney pan, a space of 4 in. being left between them and the staves, or wooden sides. The pulp is discharged from both sides of the battery into cars, which convey it into the pans. One of Blake's patent rock-breakers is also in use, which is calculated to crush 25 tons in 24 hours. On the road near the mill is a large Fairbank's scale for weighing ore. After passing here the team is driven into the upper storey of the ore-house, and its load discharged into the basement below, which is 5 ft. above the dry kiln, where the ore is dried preparatory to crushing. The machinery was all built by Prescott and Scherdel, of Marysville, Cal., and shows good workmanship. It is first-class, having all the latest improvements, and cost, without transportation, \$13,000 in gold. Mr. W. H. Allen, of California, superintended the putting up of the machinery about the engine and pan-room. The millwright was Mr. James White, well known on the Pacific coast. The dimensions of the building are—battery-room, 40 by 40 ft.; pan-room, 24 by 40 ft.; engine-room, 40 by 26 ft.; retort room, 14 by 24 ft.; and ore-house, 40 by 40 ft. The battery room is 22 ft. high. The mill generally is first-class, and finely fitted up, having cost \$40,000. It is considered that the dry is much better than the wet process for crushing these base metal ores. There are a few arrastras being worked in the canon; one, owned by J. D. Lomax, is run by a water-wheel 18 ft. diameter. He uses also a Wheeler pan for amalgamation. A short distance from this mill I met an old white miner, Mr. G. M. Garrish, and through his kindness I was enabled to go through the works of the

OPHIR MINING AND SMELTING COMPANY, owned by Colonel Weightman and Co. There is one furnace in operation, and a new one is being built. The former is 14 ft. from the top to feed-hole; 30 in. diameter at top, 40 in. in the middle, and 30 in. at the bottom. They have a 16-horse power engine, and a No. 7 Sturtevant blower. About 2 tons of bullion are made per day; which, they inform me, is free from dross and very pure. There are three tuyeres to this furnace. The fire-bricks are made of proper shape, and are 8 inches thick. It takes 12 to go round the furnace. Mr. Garrish is a practical man in this line of business, and deserves great credit for the successful manner in which he has carried it on.

FORMATION OF THE DISTRICT.—All, or nearly all, of the mineral is found in what is generally known among miners as blue lime, interlaced with and containing deposits of white and black calc-spar, which is found in the greatest abundance in the vicinity of the chloride deposits. The black spar invariably accompanies the chlorides, and is looked upon by the miners of Lion and Silver Hill as an unfailing sign of their being near at hand. On the base range there is a stratum of red quartzite, about 100 ft. thick, covered by a heavy body of dolomite shale, which is again covered by the blue lime, extending to the summit of the range. With the exception of this belt of quartzite, &c., the country rock of the district is limestone, stratified, and although several promising veins of ore exist in regular walls, well defined, and having a vertical position, the mines generally occur in strata having the same position as the rock in which they are found.

CAMP FLOYD DISTRICT joins Ophir on the south, and is about six miles distant. The ores are nearly all free, some of the chloride ledges being very extensive, and producing large quantities of high-grade ore. The Sparrow Hawk and Mormon Chief are the prominent mines in the district, and are attracting considerable attention. A deposit of cinnabar has also been discovered, and specimens have been found running as high as 30 per cent. The mines are being rapidly developed, and a mill will probably be running here shortly. The country rock is the same as that in Ophir, running into a slate or shale to the south, as the hills decrease towards the valley.

AMERICAN FORK DISTRICT.—The Miller is the representative mine here, and is doing well. At Forest City there are some furnaces in operation, and more are being erected. Timber is plentiful, and as a consequence charcoal for smelting purposes is cheap. The ores are of the same character as those in Tintic, the geological formation being the same. Throughout the district times are lively, and a large number of men are at work, at fair wages. Leaving here, we travel a short distance to

STOCKTON CITY, which is a thriving little place in Tooele county, the same as at Ophir district. A hotel is being built here, and the place is otherwise improving. The mines are located about one mile from the city, in the low foot-hills, and the principal ones are the St. Patrick, Grand Cross, Quandary Lode, and Metropolitan. I rode out in company with Messrs. Murphy and Chase, prominent men in the district, to visit the above ledges. In 1864 the 2nd. California Cavalry, under General Connor, was stationed about a mile from here, and some of the soldiers, while prospecting, discovered quartz croppings, and made a few locations. They also built some small smelting-works, but were unsuccessful in their endeavours. The district is called Rush Valley. The first mine we saw was the

GRAND CROSS, located in 1870. The tunnel, running north, is in 75 ft., and then they follow the ledge by an incline of 20 ft. in length. The average width of the lode is about 3 ft., running east and west, with a dip of 45°. The ores are red oxide and galena. The vein, between lime rock and porphyry formation, belongs to the Messrs. Pexton and Sons. The

ST. PATRICK is the representative mine of the district. It is situated on Mineral Hill, and was located in March, 1871. There are two shafts, 200 ft. apart, respectively 60 and 70 ft. deep. The ledge runs east and west, dips 80°, and averages 5 ft. in width. A force of ten men are extracting ore for the smelting-works in the district. The general character of the ore is galena and carbonate of lead, and will assay on the average 63 per cent. lead, and \$38 per ton silver. They are taking out 5 tons daily, and intend running a tunnel to tap the ledge at a depth of 130 ft. The

QUANDARY LODGE is located in Silver Canon, and belongs to E. C. Chase and others. The shaft is 107 ft. deep, and two drifts have run, respectively 20 and 12 ft. in length. There are now 25 tons of smelting ore on the dump. The foot-wall is lime-rock, and the hanging wall porphyry. The first-class ore assays 52 per cent. lead and \$30 in silver. It is principally chlorides and grey carbonate. Near by is the

GREAT BASIN TUNNEL, owned by General Connor. They have run in 80 ft., but are not working at present.



The MUSCADINE LODGE, owned by Anderson and Co., is 3 ft. wide. The incline is down 30 ft. The METROPOLITAN ore averages \$40 per ton in silver and 63 per cent. lead. In the first 15 ft. the rock yielded \$35, in the next 35 ft. it yielded \$65, and when 100 ft. down it paid \$80 per ton. The SILVER KING MINE, owned by General Connor, has a shaft down 240 ft. The ore will yield 60 per cent. lead, and \$40 per ton in silver. The

TUCSON LODGE, owned by Barry and Pardee, has a shaft 50 ft. deep, on a vein 2½ ft. wide.

WATERMAN'S SMELTING WORKS are situated about one mile from Stockton City, near the end of the Lake, and are owned by Mr. H. Simons, of Philadelphia. These works, erected in May, 1871, have been treating ore from the Rush district very successfully. They have a large round furnace for roasting ore before smelting, 12 ft. wide at top and 6 ft. at bottom. The charges remain in from three to six days, which greatly facilitates the process of smelting. A Gates' patent crusher (of Chicago) is used for breaking ore before putting it into the furnace. The lining of the furnace, which is from 30 to 40 in. diameter, is made of stone found here, and stands the heat well; all the necessary materials for fluxing are to be found in the vicinity. Nearly 8 tons of ore are smelted daily at the works. The bullion is sent to Omaha and Chicago; but the proprietor says that he would prefer to ship to Francisco, if satisfactory arrangements could be made with parties in that place. The owner of the works is building another furnace near by, which will be ready soon. —Scientific Press (San Francisco), Sept. 23.

W. H. M.

## FOREIGN MINING AND METALLURGY.

The condition of the coal trade in the French departments of the Nord and the Pas-de-Calais has experienced scarcely any change; the production continues only limited by the means of extraction and delivery. At Paris transactions in coal have been very active, notwithstanding the high rates prevailing for coal and freight. The French iron trade remains in a relatively satisfactory state. In the Nord the French ironworks are well provided with orders, and every day brings forward new ones. Manufacturers of plates are fairly overdone with the requirements of consumption; prices range between 7½, 16s. and 8½ per ton. In the St. Dizier district the iron trade is not so active as it might be; comparatively few transactions have taken place in rough pig, and rolled coke-made iron has been neglected. Sheets have been, on the other hand, in great demand, and the manufacture of axes has been extremely active. From the Loire district it is announced that a large arms manufactory recently established at St. Etienne cannot meet all the demands upon its resources, notwithstanding that it employs 5000 workpeople; the French Government is, accordingly, about to resume working operations in the old Rives manufactory, where for some years work had fallen off. The cannon foundries continue very active; guns have been manufactured of late with a range of from 3 to 3½ miles. Steel breech-loading cannon, on a system introduced by Col. Reffye, are stated to have successfully sustained severe trials to which they have been exposed. Six batteries of artillery have been supplied to the French Government by MM. Petit-Gaudet and Co.; before they were passed the guns were fired 1000 times, and no appreciable change could be detected in them. One piece was fired three times more with overcharges of powder, but still remained intact. In the Meurthe pig has made 2½, 16s. to 2½, 17s. 8d. per ton; in the Longwy district the quotations nominally current for pig are 3½, 1s. 8d. to 3½, 4s. per ton, but these prices have a tendency to check operations. Seven blast-furnaces are now in activity in this district, and two more will be lighted towards the close of this month. The concern known as the Forges et Chantiers de la Méditerranée will pay on Nov. 1 a dividend on account for 1871, at the rate of 1½, 4s. per share. The Grasse-Sassou United Mines Company is paying the balance of the dividend for 1870. The Rive-de-Gier Collieries Company will pay Nov. 26 a dividend for the first half of 1871, or 1s. 3d. per share.

The prosperity of the Belgian works producing iron and pig continues unabated, and is, indeed, increasing from day to day, almost all the works being overdone with orders. The production of Bessemer steel is being developed more and more; thus the Ougrée blast-furnaces have commenced making Bessemer pig, and the Seraing Works are about to follow the example. This policy will render Belgium less dependent upon foreigners for this important article. Ralls continue comparatively neglected; an adjudication for the Belgian State lines, however, took place on Wednesday. In the arrondissement of Charleroi, in consequence of the continuation of a great demand for construction plates, prices have been carried to 9½, 12s. for No. 2, 10½, 8s. for No. 3, and 13½, 12s. per ton for No. 4. Higher prices have been offered for deliveries to be made within a limited period. The nail and other works can scarcely keep pace with the orders which reach them from all quarters, and some of them are, in consequence, extending their production. It may be observed that during the war the Belgian nail-works obtained a portion of the business previously done by French nail-making houses; this new connection they have not wholly lost, and there has been, in consequence, a sensible increase in the exports of Belgian nails. No. 5 pig is quoted at Charleroi at 3½, 14s.; No. 4, 3½, 16s.; No. 3, 3½, 18s.; No. 2, 4½, 24s.; and No. 1, at 4½, 24s. per ton. Speckled pig, A, has made 4½, 2s.; ditto, B, 3½, 18s.; ditto, C, 3½, 14s. per ton. Pig for rails has brought 2½, 12s., and white hard iron pig 3½, 2s. per ton. Rolled iron has made 6½, 16s. to 7½, per ton for No. 1 first class; some rolling-mills have just adopted definitively the last-mentioned price. Plates are quoted at 9½, 8s. to 10½, 4s. per ton for Nos. 2 and 3; some works have disposed of rather important lots at 9½, 12s. per ton for ordinary plates, 10½, 8s. per ton for boiler-plates, and 13½, 12s. per ton for extra plates. The effects of the annexation of Alsace and Lorraine begin to make themselves felt in a manner which merits the notice of all attentive observers. Thus, the house of Wendel, at Hayange, have been enabled to carry off, at prices much below those of numerous competitors, a contract for 12,500 tons of rails, which was let a few days since at Carlsruhe. The ironworks in the neighbourhood of Liège are overdone with orders, and prices are very firmly supported. The production of iron tubes has been carried on with much success of late by the house of Chaudoir, at Grivegnée, near Liège. The manufacture of arms has been gradually experiencing a great change in the Liège district; they are now made almost everywhere by means of machine-tools; a good many works are already equipped in this manner, and the establishment of MM. Nagant Frères, at Longdoz, is being fitted up with a view to the special manufacture of the Remington rifle, which the Dutch Government has adopted. The Meuse Steam Towing Company is beginning to render important services. Transactions in coal in the Charleroi basin are only limited by means of transport, which continue to make default. The Eastern of France and the Belgian State Railways appear to be the only lines which have a good stock of plant. In the Liège basin, putting aside the transport question, the state of affairs is favourable; the local consumption is considerable, and the orders from the interior for domestic qualities are very well sustained. The high price of Ruhr coal has induced German consumers to send orders to the Liège basin. The three railway administrations which accommodate the Ruhr basin now recognise, it is stated, the necessity of creating special stations for the formation of coal trains, so as to relieve the principal stations. The Berg and Mark and the Cologne and Minden Companies endeavour to utilise their rolling-stock as thoroughly and as efficiently as possible by running special coal trains at a high rate of speed.

Ruhrort is becoming one of the most important coal centres of the Continent. The quantity of coal dispatched by boats from this point is now stated to be 1,700,000 tons per annum. The Prussian Government is constantly increasing the dock and warehouse accommodation, so as to facilitate commercial transactions, and to increase the preponderance, which the town has for several years possessed in the centre of Europe in connection with the coal trade. Ruhrort is known by the great metallurgical works of the Phoenix Company, and by its proximity to the important industrial centre of Oberhausen. The exceptionally favourable situation of the Phoenix Works, and the immense future assured to the industry of Westphalia, has especially attracted of late the attention of capitalists. A Franco-German company, under the designation of the Rhine Steel Works Company, has just created in the neighbourhood of the Rhine basins some vast

establishments for the production of cast-steel on the Bessemer process. The works, commenced shortly before the outbreak of the late war, have been pushed forward with energy, the greater part of the establishment is in activity, and the whole will be in regular operation by the close of the current year. The annual production will be about 20,000 tons.

Copper has been pretty well maintained upon the French markets; upon the German markets there has also been a satisfactory current of affairs. At Rotterdam, Russian crown has made 51 fls.; and Drontheim, 50 to 52 fls. Tin has been well supported upon the German markets. At Rotterdam tin has been very firm; considerable transactions have taken place in Billiton on the spot and under sail at 80 fls., and in Banca at 81 to 81½ fls. A telegram from Batavia states that on the 6th inst. 8000 piculs of Billiton were disposed of by public sale at 86-93 fls. per picul. Lead has been hardening in Germany, and transactions have displayed more animation. At Rotterdam, Stolberg and Eschweiler have made 11 fls., and German lead of various marks 10½ fls. At Marseilles rolled zinc has brought 28½, per ton, and zinc in plates re-cast 17½, 16s. per ton.

## FOREIGN MINES.

ST. JOHN DEL REY.—Morro Velho, Sept. 12: Produce for August, 12,453 oltas, from 4807 tons of ore, yield 2,590 oltas, per ton. Cost for August, 4167½; profit, 4967. Produce 11 days of September, 2054 oltas; yield, 1,950 oltas, per ton. Cost for September, 4254½; profit, 3078½, 8s. 3d. The escape of fine gold from the strake-house is unusually small; great care and vigilance are being exercised in passing the auriferous material through the canvas. I have again the satisfaction of reporting a good produce and corresponding profit, and the great pleasure of announcing that in the 25 m. level, driven for more effectually draining Canoa and Curve, and our deepest part, a rich line of gold was gone through on August 12; the richest part cast, below the level, cannot be worked on before sinking is again prosecuted. Ascending westward we may be able to follow it when the ground is drained, but are of opinion that it will be more advantageous to engage it in strong operations on the Canoa, to which body of lode we think it has reference. The pieces of gold taken out are the largest I have seen for a very long time, and being taken from, as before stated, our deepest part speak strongly for the future of Maquina. The shoot of lode at Alice's west maintains its size and auriferous properties. From the 25 m. level we shall open a communication, so as to relieve us from trouble with water in sinking it on to this horizon. Auriferous ground has been struck at Bryant's level, but whether we have shot or whether not in connection with the Canoa and Curve, we are as yet unable to report with accuracy. The attendance of the force has been good, and the works carried on with vigour. The lodes worked on have been Alice's west, No. 6 Curve, and Canoa. That intersected in the adit straight level will be opened on in September, as also that cut at Bryant's. Communications from the adit level to Vivian's shaft and stopes on Canoa have progressed. The middle adit has been fully manned, and upwards of 5 fms. driven; ground very hard, but the 25 m. level for effectually draining the lodes above this horizon have been regularly carried on, and the level under Canoa and Curve will be suspended next month, that under No. 6 carried on; another will be shortly commenced to drain the No. 8 (Alice's west). The ground in Maquina will be effectually drained requires to be extensively opened up. An adequate force has been kept working on the exploratory works at Tambor and Mato das Cobras; at the former, from a sparry branch gone through in the cross-cut, two or three samples showed a grain or two of gold, of no importance unless richer ground is discovered in connection with it. We have driven a level with staves eastward on the lines, and stuff broken from the same passed through a strake, but without any as yet favourable result. As large a number of hands as possible has been concentrated on work in connection with permanent pumping machinery, and a good progress made. The greater proportion of the overburden making sides of excavation has been removed, and a commencement made to fix stonework. A new dwelling-house is required for three men, and will be commenced in a few days. The level under Canoa and Curve will be thoroughly washed, and the running work carefully attended to. The stock of materials is good. The supply brought in is not large, but adequate.—First Division of September: Produce weighed to date, 5,000 oltas. Attendance good, and the features of the mine most promising. An average quantity of stuff has been taken from the shoot of lode in Alice's west and Canoa, and a portion from lode under Curve and No. 6, about the horizon of the old shaft-shoot. On the lode in level we are opening westerly a small excavation, which gives strake work; but the lode in Bryant's level has not yet advanced, the force being still engaged in timbering old workings at Alice's. The works at the adit level and middle adit have been regularly carried on. The level north from the 25 m. cross-cut, having attained the required distance, has been suspended; the one for more effectually draining No. 6 is being pushed on. Arrangements for sinking below the 25 are in an advanced state, and we hope to be in order by the time the large wire-rope arrives. Nothing new at exploratory works. 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## ASCENDING AND DESCENDING MINES.

The exhausting nature of the labour performed by miners in ascending and descending mines by ladders was recognised as involving an enormous waste of energy almost as soon as deep mining began to be practised, and from the reports of the earliest reports of the Royal Cornwall Polytechnic Society, just issued\* by Mr. Tregaskis, of Falmouth, it appears that one of the first objects of that very useful society was to endeavour to enable the men to reach their working places without unnecessary exhaustion and fatigue; for in the second report we find it remarked that the exertion of ascending and descending the ladders, which in deep mines necessarily extend to the depth of from 1200 to 1500 ft., is laborious and painful in the extreme, and often renders them totally inaccessible to the scientific and curious enquirer. The daily recurrence of this fatiguing exercise is attended with the most pernicious consequences to the miner, tending materially to impair his physical energies, to injure his health, and to considerably shorten the duration of his life. These ladders, being unprotected and naturally liable to decay, miners are continually exposed to serious and fatal accidents, melancholy examples of which are constantly occurring; and if to avoid the fatigue of the ladders they are induced to ascend in the buckets the danger becomes still more imminent, on account of the obliquity of the shafts. It should also be observed that the practice referred to must necessarily be attended with considerable loss to the adventurers. The amount of physical strength which is expended in ascending and descending the ladders must, of consequence, be subtracted from that which the miner ought to devote to the interest of his employers, and the result of his labours must be proportionately diminished.

Concerning the amount of labour thus wasted, an interesting calculation is appended to the statement, whereby it is shown that a man weighing 160 lbs. in ascending 260 fms. in one hour, which is below the average computation, he exerts a constant force equivalent to that required in raising 4160 lbs. one foot in a minute, or rather more than one-eighth of a horse-power; and supposing one-third of this force is expended in the descent, since a man could not continue such an exertion more than four hours, one-third of his whole physical strength is exhausted in going to and returning from his work, and it was estimated that, even taking the average of all the miners employed, the loss of physical strength is not less than one-fifth. The disadvantages are equally serious to the miner and adventurer, who, according to the system of mining in Cornwall, are equally interested in the amount of work completed, and where a great number of men are employed the loss accruing to the latter must be considerable. With a view to find a remedy for these evils, Mr. C. Fox offered, through the society, three premiums for the best and most efficient plans for that object. In consequence of this, several highly ingenious plans were submitted, and Mr. Michael Loam, of Consols, had the honour of receiving the first premium for his design; Capt. W. Nicholas, of Wheal Trannack; and Capt. T. Richards, of Wheal Vor, taking the second and third premiums respectively, the principle of all the machines being identical—that of the common man-engine.

The design of Mr. Loam is described as consisting of a rod attached by a parallel motion to a beam connected with the moving power, and having an alternating action in the shaft; to this rod platforms were affixed at regular intervals, the distance between them being equal to the length of the stroke. In the shaft were corresponding platforms, coinciding with those affixed to the rod. It was proposed that the men should pass successively from the platforms on the rod to those in the shaft and back, till they are raised to the surface or lowered to the bottom. The plan is described as admitting of two rods alternating with each other, in which case the men might pass from one rod to the other, and a saving of one-half the time would be effected. Sufficient time for allowing the men to pass from one platform to another is provided by an eccentric motion. In Captain W. Nicholas's contrivance the two rods are connected by cranks to the moving-power, worked with a reciprocating motion, platforms being affixed to the rods at regular intervals, and coinciding with each other at the termination of each stroke. The men pass from platform to platform as before. Capt. Richards's arrangement consisted of a car, intended to contain a certain number of men, to the upper part of which two cogged wheels were fixed in a vertical position; these wheels worked in racks, which were continued down each side of the shaft. In the reprint the several descriptions are accompanied by diagrams, which render the precise details of each machine very readily understood.

\* The First and Second Annual Reports of the Royal Cornwall Polytechnic Society, 1833-34. Falmouth: Tregaskis, Church-street.

## MYSTERIES OF THE VITAL ELEMENT.

Since the proposal to recognise the existence and investigate the nature of the so-called Psychic Force was seriously made by Mr. William Crookes, the interest felt by many in somnambulism and its allied conditions has greatly increased; it is, therefore, not surprising to find that Dr. COLLYER'S work\* has already reached a second edition. As to the interesting character of the book there can be no question; and as its object is to establish the author's claim as the original discoverer of modern anaesthesia on the ground that no one antedates the publication by him, in May, 1843, of the statement that "the inhalation of narcotic and stimulating vapours produce a state of unconsciousness," it should be carefully read and impartially considered by all who possess the feeling, which is alone worthy of Englishmen, that every man, whether he be connected with science, industry, commerce, or ought else, should have the fullest credit for whatever he may do for the advancement of knowledge or for the benefit of his fellows.

For many years Dr. Collyer's name has been familiar to the readers of the Mining Journal, and as (it may be from the unusual development of psychic energy of which he can boast of possessing) he has at various times sought to confer benefits on the miner, by inventing an improved and ingenious machine for the extraction of gold from quartz; on manufacturers and the literary world, by introducing improvements in the treatment of heat for paper making purposes, and in the production of lead pencils; and on the medical profession, by teaching them the true nature of anaesthesia, it would be unjust in the extreme to permit his most successful efforts to be passed by comparatively unrecognised. The production of anaesthesia, in order to facilitate the performance of surgical operations, must certainly have been understood more than 40 centuries before the Christian era, for even in the account of the Creation a deep sleep was caused to fall upon Adam in order that the removal of one of his ribs and the closing up of the flesh instead thereof could be more conveniently effected, but as all departments of manufacturing industry must then have been quite in their infancy, Dr. Collyer's claim to be the discoverer of alcoholic anaesthesia is not in any degree vitiated by that fact. Indeed, Dr. Collyer seems only desirous of claiming what he is justly entitled to, and he tells us that the vestiges of early history show that the art of producing a comatose state was connected with the mysteries and ceremonies and customs of the priest and the magician; referring, in continuation, to the narcotic cake used by the Egyptians in their ceremonies, to the initiation into the mysteries, to the cake used in the initiation of Trophonius to put the Pythons to sleep, to the poppy juice given to the initiates into the mysteries of Venua, to the use of *atropa mandragora* by the Greeks, and of *cannabis indica* by the Chinese, and to the writings of Pliny, Dioscorides, and others on the subject.

But Dr. Collyer's claim being in connection with modern anaesthetic discovery, the greatest interest will attach to the record of what has been done since the beginning of the present century. In 1799 Sir Humphry Davy used the prophetic words that "as nitrous oxide amongst its other properties has that of destroying physical pain, it may probably be employed with advantage during surgical operations, in which there is no great effusion of blood." The next interesting case to which Dr. Collyer refers is that of Prof. Cloquet's patient, Dr. Chaplain, he tells us, "magnified a lady who, having a cancer of the breast, an operation was considered indispensable to save her life. She was thrown into a deep sleep. She then undressed herself, and took a seat in an arm chair, sustaining the operation of the entire extirpation of the breast, which lasted 12 minutes, without the least manifestation of pain. On being awakened some time afterwards, she had not the least recollection of what had taken place. The operator, Dr. Jules Cloquet, is the professor of anatomy in the Paris School of Medicine, and member of the Institute of France."

The evidence, however, of the justice of Dr. Collyer's claims, which is calculated to have the greatest weight with the profession in England, is probably that of Dr. B. W. Richardson, F.R.S., who, in a paper on the action of the methyl and allied series of anaesthetics, and, indeed, the first published case of surgical operation under anaesthetic sleep was performed by Dr. Collyer on a person who had been rendered insensible by breathing the fumes of alcohol." Dr. Collyer's account of this operation is most amusing. Dr. Collyer's father was managing director of a distillery on the banks of the Mississippi, and some of the negroes employed on the plantation had made a secret entrance to the distillery, so that when a favourable opportunity presented itself they could treat themselves to a private inhalation, which was accomplished by mounting the sides of the large vats containing the rectified spirits; they partially removed the cover so as to put their heads under the canvas which surrounded the top of the vats. "There they would inhale the rum atmosphere, experiencing the exhilarating effects of partial intoxication, which were similar to the breath-

\* "Mysteries of the Vital Element, in connection with Dreams, Somnambulism, Trance, Vital Photography, Faith and Will, Anaesthesia, Nervous Congestion, and Creative Function: Modern Spiritualism Explained." By ROBERT H. COLLYER, M.D. London: Henry Kinslow, Strand.

ing of nitrous oxide gas. On this occasion 'Bob,' from being more sensitive than the rest, fell from the vat, a height of some 10 ft., and in doing so dislocated the hip joint. The other negroes occupied themselves in putting his leg in various comical positions, which would have been impossible but for the dislocation. This fact, to the negro mind so curious, with their excited state and their inability to bring 'Bob' to consciousness, caused them to be seized with a sudden sense of the ridiculous, which at all times is peculiarly developed in the negro character; they, regardless of their situation, set up a shout of laughter—the well-known 'Yah-yah-yah'—which led to their discovery. 'Bob' was taken to the plantation hospital, where, on examination, Dr. Collyer found the head of the femur thrown on the dor-sum of the ilium; but as the muscles were all relaxed no resistance was offered to the reduction of the dislocation. It was full half-an-hour before 'Bob' returned to consciousness."

As to the contending claims of Wells, Morton (sometimes erroneously supposed to be the well-known Professor S. G. Morton), and Jackson, considered in relation to those of Dr. Collyer, there can be no question that all the evidence is in favour of Dr. Collyer, who most certainly published, in 1842 and the two following years, two most important facts which the investigation of the professor has since discovered to be correct:—1. That the anaesthetic state is a nervous congestion of the brain in contradistinction to an increased flow of blood to that organ.—2. That any stimulating vapour when inhaled tends to produce the anaesthetic state. His present volume is essentially a popular work, and for this reason much that is introduced is related in language that cannot be termed strictly professional; yet every statement seems to have been fairly dealt with; so that if it be urged that in some parts the style gives evidence of slightly abnormal mental excitement, it will be admitted that the Doctor has produced a most readable book, and one which will throw more light upon nervous congestion, animal magnetism, mesmerism, somnambulism, dreams, spiritualism, vital photography, and allied subjects than can be obtained from any other volume as readily within the reach of all classes of readers.

**PRESERVATION OF SIGHT\*.**—This is the title of a small duodecimo of about 100 pp., by Dr. DAVID SMITH, formerly assistant to Dr. Mackenzie, of Glasgow, a gentleman of European reputation as an oculist. Dr. Smith seems an apt pupil of his great master, and has treated his subject graphically and with precision. The chapter on "Mechanical Injuries to the Eye—What to do in emergencies," renders it of great value as a place in the library of every mining village, or in those districts of iron manufacture removed from medical appliances and skill. Dr. Smith, being a practising oculist, has in these few pages given the cream of many a learned volume in popular language, as well as the results of his own experience.

\* London: Hardwicke, Piccadilly; and all booksellers.

## Meetings of Mining Companies.

## NORTH HENDRE LEAD MINING COMPANY.

The first ordinary general meeting of shareholders was held at the company's office, Westminster-buildings, Chester, on Oct. 13.

Mr. HENRY R. BOWERS in the chair.

Mr. J. JONES (secretary) having read the advertisement convening the meeting, the following report of the directors was presented:—The directors have the pleasure of presenting their first report under very favourable circumstances. The statement of accounts will show that the company is in a healthy financial condition; and the report of Mr. Walter Eddy, the company's engineer, will enable the shareholders to judge of the present prospects of the mine. The sales of lead during the year have been from ore got in the driving of the level only. Every effort is being made to get the new shaft down, but the ground is very hard, and it is not expected that the level will be reached before March next. The revenue account shows a balance to credit of 1267. 5s. 7d. This sum is available for a dividend, and it is recommended that the shareholders declare a dividend of 2s. 6d. per share on the fully paid shares, and 3d. per share on the new shares, being at the rate of 51 per cent. on the paid-up capital of 21,897. 5s. The condition and prospects of the mine are so encouraging that the directors have every expectation of very considerable quantities of ore being obtained when the ground is fully developed; and the shareholders may be congratulated on possessing a very valuable property. The directors request the attention of the shareholders to the 1711 unissued shares. It seems desirable that some decision should be come to as to whether they should be issued at present, or otherwise reserved. Two directors retired according to the Articles of Association, and the lot has fallen upon Mr. Henry Hughes and Mr. John Lloyd. The directors have given their time and close attention to the interests of the company without fee or even expenses out of pocket during the past year; but they submit that the shareholders will not expect this of them in future, and that at least railway and other legitimate expenses be paid out of the revenue of the company. The agent of Rhymyryn has made application for a small donee lease of the site of the new shaft, and the directors recommend that five guineas be voted by the shareholders.

The following report of the company's engineer was also presented:—From Llanguollen, Sept. 30.—In handling your my report I have much pleasure in being able to congratulate you on the present appearance and future prospects of your mine. I made a careful inspection of it yesterday, and I never saw it looking better than it now does, or with a better prospect for permanence. The driving of the level has been discontinued until the shaft is down on a level to communicate with it. Two levels were started from the bottom of the drop or cross-joint (see plan and section); one has been driven 6 yards to the north, through a fine course of solid ore fully 4 ft. wide, and it is quite as rich in the forebrest as in the side or roof. This end has been stopped for some time, as more ore was being got in driving it than was required to make up the 25 tons a month. Six men are employed in driving the south level at 21.18s. a yard for going and coming, and the level is now 28 yds. from the cross-joint, and it has been driven in good ore for the whole distance. From the appearance of the ground in the forebrest I am satisfied that it will improve in richness in this direction. The ore is getting stronger, more solid, and the limestone more jointy, with strings or feeders of ore, and there is every indication that this end will prove equally as rich as the north one. The length of the level to the east, from where it starts from the adit, is 176 yards. The new shaft is down 68 yards 2 ft. 4 in. from surface, and has to sink 28 yards more before it gets down to the depth of the level, and I consider that it will take from three to four months more before the communication is made. The price given for sinking is now 7s. a yard. The limestone in the bottom of the shaft is hard and close, but I expect that easier ground for sinking through will soon be met with, as they will be getting into the white limestone. Should this shaft be sunk perpendicularly to the depth of the level the latter will have to be driven 18 yards to meet it. The only operation I would advise being carried out until the new shaft is deep enough to communicate with the present workings is to keep up the present returns, and the parallel level that was met with in the adit level will thus be intersected without the aid of a cross-cut. There is every evidence that the ore now being got is from a "flat," which is likely to merge in the east and west lodes when it joins them, and at the junction to make large deposits of ore. Some of the largest and richest deposits of ore met with in Flintshire were found in "flats," such as the Vawn, Mount Pleasant, and other mines.—WALTER EDDY.

The CHAIRMAN, in moving the adoption of the report and accounts, wished to congratulate the shareholders upon the very satisfactory state of their property. By comparing their engineer's present report with the one issued to the shareholders in June last, he thought that their progress had been exceedingly satisfactory. In the June report their engineer was "gratified to give such a highly favourable report of the richness and future prospects of the mine;" he tells us that the lode was for 10 yards 3 ft. 6 in. wide, and nearly solid ore; that the level since his previous report had been driven 20 yards through a splendid course of ore, and that "at the junction of what was called the north and south vein the ore was fully 7 ft. wide." This was very encouraging, but in the present report he says that "he never saw the mine looking richer than it now does, or with better prospects for permanence." It is exceedingly pleasing for the directors to-day to inform the shareholders that in the driving south, referred to in Capt. Eddy's report, the east and west vein had been broken into this morning, containing a splendid body of solid ore; this is very cheering, and they feel that the mine is now unquestionably a very valuable property. Coming home to the figures, they have sold during the year 160 tons of ore, at an average price of 121. 16s. 3d. per ton, realising 2497. 17s. 6d. The cost, royalty, trespass, and general expenses have been 921. 11s. 11d.; leaving a balance of 1576s. 5s. 7d. He recommended paying a dividend of 1892. 19s. 3d., being 5 per cent. upon their paid-up capital, free of income tax, and wished to draw attention to the fact that the lead had been obtained in driving the level only. The reserves had not been touched at all. He did not wish to mention the quantity they expected to produce in the coming year, but the shareholders may safely calculate upon very much greater things than they are doing now. The new shaft very materially retards the progress, but they fully expected to have it holed through by March. There are 1711 shares unallotted; these have been to the board a subject of consideration for some months past. They thought that as they did not require the extra capital, it would be better to reserve them for future contingencies. On the other hand, some of them thought that it would be better to have the shares pro rata to present holders. The directors were to have the opinion of the shareholders generally upon this question. He had very great pleasure in formally moving the adoption of the report and accounts.

Mr. BROMLEY, in seconding the motion, remarked that he had no objection to call the large deposit of ore running north to south for several yards, and being 4 ft. wide, of solid ore, a "flat," and hoped it would long continue, and prove as productive as the Vron Yawnog and other "flats" in the county of Flint. At the same time they had without a doubt a distinct vein of great promise. He felt very confident the mine would produce at least 100 tons per month when the new shaft is down, and at proportionately less cost than any other mine in Wales. As the Chairman had remarked, they had not touched their reserves, &c.—the simple reason that when the new shaft is down they could raise the ore at a cost of a few shillings per ton, whereas now the expense of raising was heavy, and the ventilation so bad that they could only put one set of men to work on the ore ground. He thought the shareholders should have their attention drawn to the price of their ore, which was considerably above the average price. The round ore yesterday was sold at 141. 1s. per ton at the mine. The motion was carried unanimously.

Messrs. John Lloyd and Henry Hughes were re-elected directors, and it was

resolved to call a special general meeting for Nov. 10, to elect two additional directors, and William Byron Fox, Esq., Manchester, and J. Williams Lloyd, Esq., J.P., Denbigh, were recommended for election.

The meeting thought it advisable to allot the unissued shares pro rata to the shareholders.

Mr. WILLIAM ROWLAND proposed the payment of the dividend recommended by the directors, and Mr. WRIGHT, as the largest shareholder, seconded the motion which was carried.

The following resolutions were also passed:—"That Mr. John Caldecott be appointed auditor at a fee of three guineas for each annual account."—"That a donation of five guineas be presented to the Vicar of Rhymyryn in aid of the building of a new school for the parish."—"That the best thanks of the meeting be presented to the directors, solicitor, and secretary for the care and attention they had bestowed on the business of the company, and that the directors be desired to take payment of their travelling expenses during the year."—"That the most cordial vote of thanks to the Chairman for his conduct in the chair and general attention to the interest of the company included the business of the meeting."

## WEST WHEEL SETON MINING COMPANY.

At a meeting of adventurers, held at the mine, on Tuesday, the accounts showed a profit of 12427. 5s. 4d. A dividend of 10007. (21. 10s. per share) was declared, and 10107. 6s. 2d. carried forward. The amount of copper ores sold Aug. 31 and Oct. 5, to come to the credit of the next account, is 32017. 18s. 6d., and of tin about 20007.

The following report was submitted to the meeting:—

Oct. 17.—South Lode: The lode in the 185 fm. level, 43 fathoms west of Harvey's shaft, is 4 ft. wide, composed principally of quartz and peach, which is a good indication for lead and copper. The lode in the 162 fm. level, 116 fathoms west of shaft, is producing a little tin, but not sufficient to mine.—Hilderley's Shaft: The lode in this shaft, 9 fathoms below the 150, is 6 ft. wide, and worth for tin 107. per fathom. The lode in the 150 fm. level, 37 fathoms west of shaft, is 5 ft. wide, and worth for tin 71. per fathom. The lode in the 140 fm. level, 61 fathoms west of the shaft, is producing stones of ore, and worth for tin 107. per fathom. In the cross-cut driving north in the 139, west of the shaft, we have intersected a branch in the vein, producing good stones of ore; this leads us to hope that the cutting of the north lode in this level will be favourable. We expect to cut it in about two months. The lode in the 120 fm. level, 58 fms. west of shaft, is producing 2½ tons of ore per fathom. The lode in the 120 fm. level, 55 fathoms west of shaft, on the north part, is producing 7 tons of ore per fathom. The lode in the 110 fm. level, 102 fathoms west of shaft, is producing stones of ore. The lode in the 100 fm. level, 96 fathoms west of shaft, is yielding stones of ore. The lode in the 100 fm. level, 88 fathoms west of shaft, is producing 1 ton of ore per fathom. The lode in the 90 fathom level, 107 fathoms west of shaft, is unproductive.—New North Lode: The lode in the 120, east of Harvey's shaft, and west of cross-cut, is producing stones of ore. In the back and bottom of the 180, east and west of Hilderley's shaft, we have five stopes—one in the back and one in the bottom of the 120, west of shaft; one in the bottom and three in the back of the 110, west of shaft—together 11 stopes, producing on an average 2½ tons of ore per fathom, together 60½ tons. Our present production is about the usual quantity for this level. In the cross-cut driving north, west of Hilderley's shaft, in the 110, we have passed through a branch about 1 foot wide, composed of quartz and peach, and yielding a little tin. Mitchell's Shaft: We are making good progress in sinking, and have set to hole to the 90 at 257. 10s. per fathom, which we expect to do by the end of this year. We have also commenced a cross-cut in the 100, towards this shaft, which will be about 9 fathoms.—MALACHI BATH, JOHN JENNINGS, WILLIAM PASCOE.

## NORTH POOL MINING COMPANY.

At the first ordinary general meeting of shareholders, held at the offices of the company, 30, Great St. Helen's, Bishopsgate-street,

Mr. RICHARD DUKE in the chair.

The SECRETARY (Mr. E. J. Bartlett) read the notice convening the meeting, together with the directors' and Capt. J. Vivian and Son's reports; the latter, which is of a most encouraging character, is appended:—

Oct. 14.—We are continuing our operations for the present to the sinking of Ballarat shaft, with as great a force as we can advantageously bring to bear upon it. In order to carry out this operation without risk of loss or hindrance, we have thought it prudent to strengthen and render our pump work more effective for deeper workings; this has been done effectually. Ballarat shaft is now 52 fms. level, the 52 fm. level, or about 85 fms. from the surface. Below the 52 fm. level the lode has occasionally presented favourable indications; recently it has improved in character, the more favourable features being a gradual increase in size with increasing depth, a less underlay, and the composition of the lode being more productive for a certain depth, after which the large deposits of ore were met with from which the greatest profits of this great mine have already been derived. In the part of this mine which was worked by a former company the copper ore was found within about 30 fms. of the surface, and continued to a depth of about 100 fms., from which large and rapid profits were made, at a time when the price of copper was about the same as it is now. The workings were then extended about 38 fms. deeper, and abandoned; but it is very important to notice that this depth is only about the same as that at which the Ballarat shaft is now being sunk, and the great mine has not yet been reached, and the general opinion of practical miners is that the same results would have followed here from persevering in depth. From the best information which we have been able to gather from miners who thoroughly knew the old mine at the time it was stopped, everything in the bottom workings gave evidence of the commencement of a great tin mine under the rich copper formation. A fact tending to confirm this opinion is that the mines which are now going for the great mine in the district are all—Barrat, Dolcoath, Langford, and East Pool—were formerly rich copper mines, and the copper formations becoming exhausted in depth, and the works having to be carried on by the raising of fresh capital, it became doubtful whether the operations in any of them should be continued or not. Fortunately they were persevered with, and the result is that large tin formations have been developed in depth, from which much greater profits are now being derived than had been previously realised from copper. Although we have not hitherto been able to avail ourselves of the great mine in the district, our machinery has not been working with a view to draining it, yet we can now look to it becoming a very valuable part of the property, as we find that by the continuous extension of the operations of adjoining mines towards us the water is being gradually drained from our ground. At present the water has sunk to the 38 fm. level, which is much lower than it has been before. This draining of the old workings is of great importance to us, and will claim our constant attention, with a view to re-opening the old workings. With regard to present operations, we advise that the sinking of Ballarat shaft should be continued, and very perfect pumping apparatus put down, and are, therefore, in a position to develop the mine with vigour at our present point of operations; or, by removing our machinery, to lay open the old mine, at a greater depth. For the present, we advise continuing the exploration of Ballarat lode.

The CHAIRMAN stated that the meeting was convened in accordance with the Companies Act, and not for the purpose of exhibiting accounts. The progress made at the mine had been satisfactory, and from his own inspection he could confirm and endorse the very satisfactory report of the agents, and he congratulated the proprietors upon possessing so fine a property. He, therefore, moved the adoption of the report.—Capt. H. A. BENNETT seconded the motion, which was carried unanimously.

Mr. A. HERON said he had visited and inspected the mine several times, and was clearly of opinion that Ballarat lode would before long prove rich, and it afforded him great satisfaction in speaking in the highest terms of the general management of the company's affairs.

Mr. E. J. BARTLETT fully agreed in the economical management at the mine, and stated that at his last visit he met several practical authorities, who, he believed, were likely to prove a great prize; the shareholders must recollect its situation, surrounded by mines that are now making large profits.

A PROPRIETOR asked as to the condition of the machinery?—Mr. W. C. VIVIAN stated that the whole of the plant was in excellent condition, and their engine (which he would remind the shareholders was the largest in the county) was keeping the mine drained, working only at three strokes per minute.

Votes of thanks to the Chairman and directors terminated the proceedings.

## KING ARTHUR SILVER-LEAD MINE.

At a meeting of shareholders, held at the offices of the company, Circus-place, Finsbury, on Tuesday, the following report from the directors was read by the secretary:—

The directors feel much satisfaction in presenting the shareholders with Capt. HITCHENS' report upon the work done, the present position of the property, and its future prospects, which further developments of the limited amount of capital sunk and the directors have not been in a position to open up the mine so largely or so quickly as they could have desired. For the same reason the 20007. purchase-money has not been paid, but so great is their confidence in the property that the vendors are willing to forego this cash payment and to take paid-up shares instead.

It is estimated that an additional sum of 20007. will be sufficient to provide the necessary machinery to carry down the shaft to the 10 fm. level, to cross-cut all the lodes, and to open up the mine at that depth. In order to obtain this sum the vendors are willing to devote the payment of the 20007. due to them as a bonus to the shareholders, pro rata, share for share for every additional share subscribed. This offer being so liberal and advantageous, the directors have every confidence in recommending the shareholders to accept it, and by this operation at once to place the board in a position to develop the property successfully.

It will be seen from the balance-sheet that neither the directors nor the secretary have received any remuneration for their services, and the board are willing to allow this matter to stand over until the company is in a more flourishing condition.

In conclusion, the directors take this opportunity of recapitulating the advantages of the property:—1. There are four parallel lodes near together, which is believed will combine and make one powerful lode in depth. 2. This is a great feature, as at the junction of lodes large deposits of mineral are usually found. The mine can be developed very economically by water-power.—3. The high price of the silver-lead ore sold—141. 5s. per ton, the ordinary price of Welsh lead ore being from 101. to 121. a ton.—4. That the mineral discovered in the



bottom of the level going down is alone sufficient to pay handsomely when the mine is opened up at a sufficient depth, and it can, no doubt, be returned in quantity on levels being driven.—5. That very few young mines can show such a prospect of mineral upon so small an outlay as that already incurred.—6. That at the bottom of the shaft, 10 fms. in depth, there is a fine course of lead holding down, thus placing the property beyond a speculation, and that it is considered by competent parties to be a *bona fide*, legitimate mining enterprise.

Under these favourable circumstances, the directors trust the present shareholders will come forward and take up the necessary capital to enable the works to be carried on vigorously, and the mine opened up with the least possible delay. The following members of the board—Messrs. Massey and Ford—retired by rotation, but being eligible offered themselves for re-election.

Capt. Emanuel Hitchens, in his report, says—"Judging from what we have already discovered, there is the strongest reason to believe that this property, with a very moderate outlay, of (say) 2000*l.*, will become a dividend-paying mine. As soon as the turbine and machinery are fixed we have only 10 fms. more to sink the shaft before opening out levels right and left, to take away the ore we have proved to be standing from the level downwards as far as we have gone. The facilities of working by water-power instead of steam, and the high price obtained for the ore, give us an advantage of economical and remunerative working which few mines possess."

[For remainder of Meetings see to-day's Journal.]

#### THE IRON ORES OF COUNTY ANTRIM, IRELAND.

At a special meeting in Belfast of the Chemico-Agricultural Society of Ulster, Dr. HODGES read an interesting paper on the above subject, of which the following is an abstract. He commenced by stating that various notices had recently appeared in scientific and other journals, drawing attention to the iron ores of the county Antrim. It was known that for many years past blackband ironstone had been mined at Ballycastle, mentioned in Banerman's work on the Metallurgy of Iron as the "Belfast aluminous ore," extremely valuable as a flux, and used for that purpose in the North of England and in Wales. Much more important than this had been the discovery, about four years ago, of extensive beds of red and brown hematite, chiefly at some distance inland from the coast in the northern part of the county, almost equal in the production of metal to the richest ores of Cumberland or North Lancashire, and producing iron of the highest commercial value. The discovery of this valuable ore, though so recent, was already exercising a perceptible influence for good both from a social and agricultural point of view, as it was an important and remunerative industrial pursuit in several parts of the county. The future, as shadowed forth by some sanguine speculators, was the utilisation of the ore on the spot in the manufacture of iron; and they looked forward to the time when furnaces would be in full operation in the county of Antrim, mining villages erected, unlimited employment given, and vast wealth created by making iron from this hitherto unknown and supposed valueless material. With regard to the practicability of the project, those who advocated it had as yet overlooked one of the strongest points in its favour, which was the advantage to be derived from using up the comparatively weak ore existing in unlimited quantity in immediate contact with the richer kind, and now thrown aside at most of the mines as useless. By way of explanation, it might be observed that there was reason to think that underneath the basalt of all the mountains of the county a seam of rich ore existed, more or less broken and irregular, and of varying thickness. The explorations in proof of this had, up to the present time, been very considerable, and the ore was found in the position mentioned in mountains far in the interior of the county. Another fact not hitherto disproved was that this rich ore only existed in any considerable quantity at an elevation of from 800 to 1000 feet above the sea level. This rich ore in the high mountains consisted of a seam of from 12 to 30 in. in thickness; the average probably not exceeding 18 in. Selected specimens had been proved by chemical analyses to contain above 60 per cent. metallic iron; the production of the mass in the furnace was much less, being probably on the average rather under 50 per cent. of metal, the difference in great measure arising from the moisture with which the ore was usually loaded, and from the difficulty of preventing an admixture with it of the weaker kind already referred to. It was, therefore, the using, if possible, of this inferior material on the spot which offered one of the main advantages and inducements for the home manufacture. It immediately underlaid the 18-in. seam of rich ore—in some instances it almost intermingled with it—was commonly from 4 to 6 feet in thickness, contained from 20 to 25 per cent. of ore, and was consequently not of sufficient value to afford the expense of carriage from those mines which were some miles distant from the sea-side. To use the two kinds in conjunction, therefore, should be the great aim of those who might attempt to manufacture iron at the mines. The question of fuel was not of so much importance, it being well-known that to many great ironworks in England fuel was brought from a much greater distance, and at more expense than it would be to bring sea-borne coals to the Antrim coast. All the other appliances, except fuel, being also at the smallest obtainable cost on the ground, it was quite possible that the prospect of the home manufacture of iron might yet be realised. Should it be so it would, after all, be but the revival of a lost trade, as iron was made in Ireland in the seventeenth century to a very considerable extent. Dr. Boate, in his "Natural History of Ireland," described at some length its magnitude and importance, distinctly mentioning the localities into which it had been introduced, the process of manufacture, the cost of erecting and maintaining furnaces, the profit obtained, the different kinds of native ore, the quality of the iron, the percentage got from the ore, the prices at which it was sold in London, the number of people engaged in the trade—Sir Charles Coote alone in his works, which were in Roscommon, Leitrim, and King's County, employing not less than 2500 men. Many other interesting particulars were given by Dr. Boate of the state of the iron trade at that early period, "all overturned and brought to an end," he said, "by the great Rebellion of 1641, and the confusion and disastrous civil wars which ensued." The great works he described were chiefly in the South of Ireland, though he made mention of two large ones in Fermanagh belonging to Sir John Dunbar and Sir Leonard Blennerhasset, both of which, no doubt, consumed the native ore. Should the manufacture of iron be again introduced into this country, which many confidently expected, and on a scale commensurate with modern ideas and requirements, it would be but another instance of history repeating itself, though in this particular instance with a difference, inasmuch as while in the seventeenth century ore was brought to the fuel, in the nineteenth the fuel would be brought to the ore, the latter being considered—for the Antrim coast at least—a much more simple, practicable, and profitable system. No movement, however, had yet been made in the direction in which the preceding observations referred by any of the iron ore companies in the county Antrim, all confining their operations so far to the mere raising and export. This was steadily increasing from all the shipping ports—Zarrie, Glenarm, and Carnalough, and equally so from Red Bay, from which the whole of the fine Glenravel ore is exported. The proprietor in that district, who was the first to introduce this valuable ore to public notice, had let all on his estate to three companies. One of these would export this year not less than 20,000 tons; the other two had gone to great expense in preliminary trials of the ground, in making roads, openings into the mountains, and other necessary operations. They have raised large quantities of ore, but as yet have not shipped much, the roads, the distance from the pier, and the inefficiency of the pier itself, forming present obstacles to the great extension which the business would otherwise immediately attain. There was also a fourth company on the Glenravel district, though on a different property. They had commenced operations with great vigour, and placed at the pit-mouth a large quantity of fine ore. The writer of this paper believed this company were the only owners of furnaces raising Irish ore, and would consequently be their own consumers at their works in England. Only about two miles of horse tramway had been constructed yet in connection with the Glenravel mines, not including, of course, the smaller tramways at the mouth and interior of the mines. Large expenditure, however, had been gone to in preparatory works at Ardalinis and other places near the coast by the Antrim Mining Company, who had many mines in different localities, and whose operations were much more extensive than those of any of the other companies in the county. Carriage to the ship's side was as yet all done by horses, and at an expense, on the whole, of from about 2*s.* 6*d.* to 4*s.* 6*d.* per ton, according to distance and convenience of roads. This referred to the distant mines in the interior only; but to so great an extent had this expenditure interfered with a fair remuneration to the mine owners that its speedy reduction had been

the constant point to which attention had been directed. The two great questions now connected with the ore were really economy of transport and good shipping accommodation; and those two requirements, both of which were practicable, must be arranged before the business could reach its full magnitude. A few months ago there was a prospect that a narrow-gauge mineral railway would have been constructed by the joint efforts of the Glenravel companies from their mines to the shipping pier at Red Bay. The line was surveyed and mapped by a competent engineer, but the difficulty of getting so many independent companies to unite in combined action, or from the apprehension that so large a sum (about 20,000*l.*) would be required, the project was abandoned until it shall have been proved by further examination that the mines will not be exhausted for an unlimited period. More recently the English Wire Tramway Company had proposed to put up a suspension tramway on their system, which seemed to be adopted in similar places and gaining in public estimation, from Glenravel to Red Bay pier, if guaranteed the annual transport of 70,000 tons of ore for a certain period, and on which they could charge 2*s.* per ton, but less on the carriage of all exceeding the minimum amount. Some other reasonable conditions were attached to the proposal, and it was still under consideration.

In the discussion that followed the reading of this paper, of which the foregoing is an outline, Dr. Ritchie, J.P., said there was one error the author had fallen into with regard to the height above the level of the sea. He knew of one place where it was not 200 feet above the sea level; and it would be more correct to say that it was to be found 300 feet geographically above the limestone. In Island Magee it was not 150 feet above the level of the sea; and, besides, he got it again at the level of the sea in Island Magee, but still in the same relative position to the limestone. He had seen some places where it was 300 or 400 feet above the level of the limestone. Dr. Hodges explained that what was meant was the best iron was generally found 700 or 800 feet above the level of the sea. In reply to the Rev. J. Bradshaw, Dr. Hodges said that the rich and the inferior ores were near each other, so that the inferior ore could be worked up on the spot without bringing the rich ore to it. There would be an advantage in having the works on the spot, as the two descriptions could be economically worked. The stoppage of the Irish manufacture of iron had been occasioned nearly altogether by the want of fuel, and the same thing took place in Dudley, till they found it would be advisable to take the coal to the iron, and he noticed that at a late meeting of iron merchants it was proposed that, instead of bringing the iron to the coal it would be more advisable to take the fuel to where the ore was. Dr. Ritchie remarked that the Antrim ore, so far as he could judge, would not work by itself in the ordinary blast-furnaces, and there must be considerable modifications in the mode of working it. Some experiments were being made at Dilton, near Liverpool, which it was hoped would be successful in showing how it might be smelted with profit. A considerable amount of time and a very large amount of money had been expended on it. There was no use in attempting the experiments first in Ireland for want of skilled labour, but in England they had every form of skilled labour and the necessary tools of every kind, and he hoped in a short time to be able to show in a practical shape how the process could be carried out at a profit. Works could then be established at Larne or Cushendall, or some place about that district. In reply to the Rev. John Jellie, Dr. Hodges said it was an ascertained fact that there was a great deal of coal about Ballycastle; but Dr. Ritchie added that the coal was of a very sulphurous nature. Scotch coal could, however, be imported cheaply. Mr. Glenny, J.P., asked whether 60 per cent. of the iron was good; to which Dr. Hodges replied, "Yes, very good." Mr. Glenny said that in the county Down, on Lord Edwin Hill's property, ore had been found which yielded 68 per cent. Some had been sent to London for analysis, and that was the result. In the conversation which followed, it appeared that several persons from the midland and northern counties of England had been inspecting the mineral deposits at Deconmat, near Dromara, where the yield would be from 20 to 40 and 50 per cent. of iron, and several parties were willing to proceed with the works, but they were obliged to wait until the Banbridge Extension Railway shall have been made.

#### THE STUDY OF GEOLOGY.

Mr. DAVID PAGE, LL.D., Professor of Geology at the Newcastle College of Physical Science, delivered a most able and practical inaugural address, before the students of the college and a very numerous general audience, assembled in the theatre of the Literary and Philosophical Society.

The Professor, who was received with warm applause, explained at the outset that the work which lay before them during the coming college session was the study of Geology—that department of natural science which treated of the structure and constitution of our planet; the rocks and minerals of which it was composed, the changes they had undergone and were still undergoing; the relics of past life embedded; and generally, the physical and vital history of the earth from the present time to the earliest traces of change that could be discovered in its rocky exterior. The science, like every other department of knowledge, had a scientific and theoretical or speculative aspect, as well as a practical, economic, and industrial aspect—the one appealing more immediately to our intellectual activity, the other more to our physical requirements. Having noticed the rapid progress of the science during the past few years, and indicated the character of the changes which were ever taking place on the earth's surface, he reminded them that the more they knew of the physical geography of the globe the better they would be able to recall its former aspects. Geology was but the physical geography of former ages. Sea and land had ever been changing places; new conditions of climate had been brought about by those changes, and under the influence of those newer conditions and the great ascensive law of vitality, newer and higher forms of life had been introduced upon the globe, and in this way the world had a history, not only of physical change but of vital progression. Nothing in Nature stood still, and while Nature repeated herself, she seemed unwilling that all traces of her former history should be obliterated, and thus in the successive rock formations she kept a record, not only of the forces by which they were piled up, but of the kind of life by which the world was peopled at the time of their aggregation.

To investigate these rock formations, to study their nature and composition, and to discover the forces by which they have been aggregated and consolidated, to map the area over which they extend, to read the fossil relics of life they contain, and from all those facts to compile something like a connected history of the earth, was the object and aim of geology—the science upon the study of which they were about to enter. Such was scientific and theoretical geology, one of the noblest and most intellectually inciting of the natural sciences; but attractive as geology was in its scientific, theoretical, or speculative aspects, it was no less attractive and important in its practical and economic or industrial bearings. There were certain callings to which such a knowledge was indispensable. The mining engineer, whether working amongst the stratified rocks of the coal formation, or following the metallic veins in the older rocks, must be greatly facilitated in his operations by a scientific acquaintance with geology. No doubt there had been and were many successful engineers but slenderly acquainted with the science; but the success of these men would not have been less, and in all likelihood it would have been many times greater, had that knowledge been early afforded to them. Empirical skill, aided by long practice and natural shrewdness, might surmount many difficulties, but the problems connected with mining were numerous, and the identification of the same formation by fossils, the area it occupied, the manner in which its rocks were disposed, the frequency with which they were interrupted by faults and fissures, the tendency they had to change their character in certain districts, and the like, were all questions which could only be solved, and solved with certainty, by the scientific geologist. Nor would he have them imagine that because hitherto any man with fair practical skill and the influence of friendship might secure a lucrative appointment, that such a state of things would long continue.

Qualification by examination was the order of the day, and many years would not pass by before the mining faculty would be subject to the same ordeal. If the captains and mates of our mercantile marine were tested as to their fitness by a board of examiners, because

lives and capital were at their skill and guidance, and if, when errors were committed, their conduct was submitted to a court of enquiry, why should mining engineers, who had many more lives and much more capital under their care, not be tested and tried in a similar manner? And, again, the civil engineer, who had to carry railways through rock cuttings, and pierce tunnels through hills, who had to bring water supplies to towns through hills and over valleys, who had to sink wells, excavate docks, deepen and widen rivers, could not proceed with due economy and security without a competent knowledge of geology, and it had simply been for want of that knowledge that so many of our public undertakings had cost so much and brought so little to their confiding shareholders. Further, the architects and builders—those to whom the beauty, strength, and durability of our public edifices are entrusted—would be aided in their choice of suitable materials by a knowledge of geology of rocks, of the facility of their excavation and dressing, and, above all, of their resistance to the weather of our fickle, severe, and trying climate. And when they looked at the decay of many of our public buildings, and some of them of very recent erection, it required little argument to prove that the structure and texture of rocks had formed no part of the study of their masons and architects. And so of the surveyor and land valuer, the emigrant and land speculator, the farmer and the agriculturist—to all of whom a knowledge of the science could not but be most advantageous. Geology, surely then, in a country like Great Britain, deserved the most assiduous culture and the warmest encouragement.

The remainder of the address was devoted to a consideration of the means to be employed in its attainment, and the offering of some practical advice to the students. Having described the character of the work in the classes, the Professor assured the students that in the fieldwork of the geologist there was a world of pleasure. There was a sort of freemasonry amongst its votaries that rendered the task truly delightful. Their motto was "Heart, hand, and hammer," and there was every reason in this world that the hand which could wield well the hammer should ever be ready with his friendly grasp, and the hand that could grasp be ever directed by the heart that could feel. Guided by the principles he had indicated, they would find geology not only an exhilarating but a profitable study, not only a source of intellectual culture and employment, but of practical profit and pecuniary reward. But hope of pecuniary reward, however legitimate as an incentive, must never form their sole motive for the study of any science, while they had inscribed on their banner "Moneo et munio" they must take care that in their conduct they did not travestie those words by a commercial one which approached them very nearly in sound. Mr. Page then urged the students to consider themselves on their trial, for their own sakes, to show what metal they were made of, and whether they were really worthy of the care and money expended on them, for the sake of their parents and guardians, for the sake of the founders and directors of the institution, and for the credit of the college itself; for its reputation in the long run would depend as much upon the character of the students it reared as upon the nature of its educational appliances.

The address was listened to with great earnestness and attention, and was frequently applauded.

**OLD SILVER MINES IN SCOTLAND.**—In exploring the old workings near Bathgate, an old hammer has been found in one of the silver mines. The hammer is now 2 1/2 inches in diameter, and about 14 inches in length. The head of the hammer is of a peculiar shape, and the main pit, or entrance to the mine, is about 12 inches in diameter, and is about 9 ft. by 6 ft. in width, and 21 fms. deep. The walls are of solid limestone rock, finely chiselled, and bearing innumerable initials of individuals, among which is "C.H.L. 1693," and beneath it a coat of arms. From the bottom of this pit shafts ran in all directions; and at the termination of one of these another pit, several fathoms in depth, has been discovered. At the bottom of this second pit other mines have been found, and at the extreme end of one of these is a third pit, which has not been thoroughly explored on account of the quantity of standing water contained in it. On the walls of this last pit the year "1498" is carved. It is surmised that the workmen had drawn the water in bucketfuls from the lowest pit, conducted it to the bottom of the second pit, and, by the same means, raised it from the second to the third pit, whence it ran along a main level, and discharged itself into a stream in the neighbourhood, where the metals were crushed and washed. The various veins of ore, and an investigation is to be made to ascertain the correctness of this supposition. Besides silver and lead, platinum has been found in abundance, and the mines are now being worked energetically.—*Scotsman.*

**GOLD FIELDS OF VICTORIA.**—Australian papers report that the gold mining interest of Victoria has, in the month following the dispatch of the July mail, been rather devoid of incidents of special interest; but the work has been pursued with steady success in all the various gold districts of the colony. Ballarat, the metropolitan gold field, has certainly not recovered from the dullness and stagnation into which it has fallen during the last year or two; but the magnificent gold-bearing quartz reefs of Sandhurst, and the general prosperity of other mining districts, compensate fully for the diminished yields of Ballarat. Even on Ballarat two matters have lately occurred which afford well-grounded hopes that the yields thence will be increased before long. One of those matters is the new system, or rather a return to the old system, of co-operative mining, many of the working miners having banded themselves together in companies to prospect ground not hitherto worked, though always held to be auriferous, and also to mine in ground only partially operated on in former years, when the incidents and apparatus of those times were not sufficient to cope with the difficulties met with. The other matter referred to is the great attention being paid to what are termed the Dead Horse Ranges, where there are some 30 or 40 square miles of gold-bearing quartz reefs, which in some places are so much as 18 ft. thick. All those reefs that have been tried up to the present time have proved auriferous in some degree. A number of co-operative companies are now at work on reefs, and though as yet they operated on are only moderately profitable, they may eventually turn out to be highly remunerative, and the country around is expected to be covered by reefs which, like many others in this colony, may be almost inexhaustible. Many of the quartz reefs in this colony now giving splendid returns to their owners or shareholders were prospected or worked upon for years before anything like good yields were obtained. The export of gold, as published in the Customs returns, affords proof of the stability and increased profitability of the gold fields. The amount of Victorian gold exported to the end of July this year was 872,490 ozs., while the amount for the corresponding period of last year was only 759,499 ozs., or 112,441 ozs. less than the return for this half-year.

**OIL GAS-ENGINES.**—The features of novelty in the invention of Mr. P. SALMON, of Mableton-place, are, firstly, certain applications to these oil gas-engines and boilers, whereby combustion under pressure is effected in the chambers of the latter. These consist of the attaching of a donkey-engine to propel an air force-pump or fan, to force air which is by preference heated into these chambers, and the placing or the fitting of a damper, or regulating stop-valve, to the superheater, or between it and the air-chest. The novelty in the second of these inventions is in the mode or method of starting or setting these oil gas-engines to work. This consists in the application of fire heat by a usual grate or fire place, or flames from an oil lamp, or gas applied to generator to produce gas from the oil therein, and with this gas propelling the donkey-engine, the exhaust of which is consumed in the boilers to raise the superheated steam from the water, which superheated steam at a high temperature passes through the oil in the gas generator, thus forming a combustible and lubricated gas, which after propelling the pistons of the engine cylinders is exhausted into and consumed in the chambers of the boilers to maintain the steam-power.

**NEW PUDDLING FURNACES.**—The invention of Mr. J. HEAD, of the Newport Rolling Mills, Middlesbrough, relates partly to an improvement on an invention patented by Messrs. Jones, Howson, and Giers in 1867, and consists in the application and use to and in the heating of a mixture of air and steam to be used in puddling and other furnaces for melting, boiling, or heating iron of stove or heating pipes of a rectangular section, strengthened internally by cross partitions, and secured to the stove-box upon which they stand by means of an improved joint, consisting of level surfaces, having a V groove in each and a piece of copper wire let therein, the parts being held together by a band larger than the pipe, and filled in outside with borings and acid to form a rust joint. A curved perforated brickwork in the crown of the furnace is substituted for the cast-iron tuyeres and tapers bars, and a valve is so situated in the blast passages leading to the crown of the furnace and as high as that the blast can be proportioned in each or entirely shut off from either whilst its full strength is turned on through the other. The improved appliances relate to non-conducting metal screens as protection against the radiated heat from the furnace and to foot plates for the puddlers to stand upon, kept cool by dipping into cold water in a tank beneath.

**THE DYNAMOGENE.**—An improved apparatus for obtaining and applying motive-power, has been designed by Mr. A. F. OSSLIN, of Paris, the invention comprises a novel law and a combination of a series of natural phenomena in a recipient, the result being a difference of gaseous pressure, which acts as a resultant on a piston, and is independent of the general conditions of applied mechanics. On account of this independence the application of the "dynamogene" is both economical and universal.

**BLASTING BY ELECTRICITY.**—The improved apparatus for generating a current of electricity for discharging fuses for mining and other purposes invented by Mr. E. WELCH, of Eden-street, Hampstead-road, consists of an arrangement of a permanent magnet and soft iron cores furnished with coils of insulated wire, a soft iron armature being provided, which is capable of being removed and replaced, and a current of electricity induced by means of a combination of mechanism acted upon at pleasure by a key.



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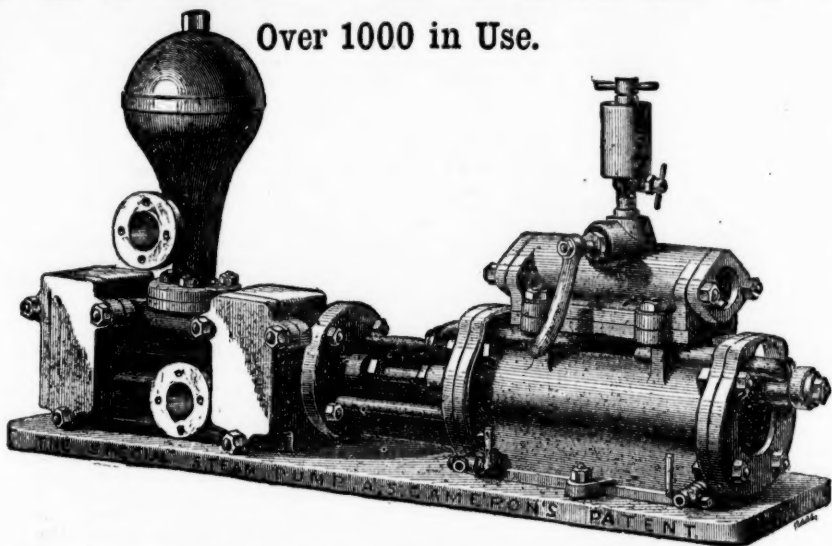
Will Force to any Height.

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#### IN USE AT THE FOLLOWING QUARRIES:—

Carnarvon and Bangor Slate Co. ...	5 Pumps.
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New Zealand Quartz Crushing and Gold Mining Company ...	1 "
Scott, R. W., Dungannon, Ireland ...	1 "
Foster, J. S., Hebburn Quarries ...	1 "

#### IN USE AT THE FOLLOWING CHEMICAL WORKS:—

Alum and Ammonia Co., Bow Common ...	2 Pumps.
Barnes, W. O., Hackney Wick ...	2 "
Burt, Boulton, and Hayward, Tar Works, Millwall ...	1 "
Cory and Co., Manor-street, Old Kent-road ...	2 "
Whiffen, Thomas, Battersea ...	1 "
Jones, W., and Co., Middlesborough ...	4 "
Jarrow Chemical Co., South Shields ...	1 "
Richardson, J. G. and N. H., Jarrow-on-Tyne ...	1 "
Read, Holliday, & Sons, Huddersfield ...	1 "
Sheldon, Nixon, and Co., West Jarrow ...	2 "
Tennant, C., and Co., near Newcastle ...	7 "
Webb, H., & Co. (Manure), Worcester ...	1 "
Union Chemical Company, Stratford ...	1 "

#### IN USE AT THE FOLLOWING COLLIERIES:—

Adelaide Colliery, Bishop Auckland ...	3 Pumps.	North Bitchburn Colliery, Darlington ...	2 Pumps.	Stott, James, and Co., Burslem ...	1 Pumps
Acomb Colliery, Hexham ...	1 "	Newton Cap Colliery, Darlington ...	1 "	Seaton Delaval Coal Company, near Newcastle	1 "
Blackfell Colliery, Gateshead ...	1 "	Normanby Mines ...	1 "	Thornley Colliery, Ferryhill ...	1 "
Black Boy Colliery, Gateshead ...	1 "	Oakenshaw Colliery ...	1 "	Thompson, John, Gateshead ...	2 "
Castle Eden Colliery ...	2 "	Pease's West Colliery ...	2 "	Trimdon Grange Colliery ...	1 "
Crofton, J. Ct., near Ferryhill ...	1 "	Pease, J. and J. W., near Crook ...	5 "	Tudhoe Colliery ...	4 "
Carr, W. C., Newcastle ...	4 "	Pease, J. and J., Brandon Colliery ...	1 "	Vobster and Mells Colliery ...	2 "
Etherley Colliery ...	1 "	Pegswood Colliery, near Morpeth ...	2 "	Widdrington Colliery, Morpeth ...	2 "
Gidlow, T., Wigan ...	3 "	Pelton Fell Colliery ...	1 "	Whitworth and Spennymoor Colliery ...	3 "
Haswell, Shotton, and Easington Coal Co. ...	2 "	Railey Fell Colliery, Darlington ...	1 "	Westerton Colliery, Bishop Auckland ...	1 "
Lochgelly Iron and Coal Company ...	1 "	Right Hon. Earl Durham, Fence Houses ...	1 "	Wardley Colliery, Gateshead ...	1 "
Leather, J. T., near Leeds ...	2 "	Skelton Mines ...	1 "	Westminster Brymbo Coal Company ...	2 "
Lumley Colliery, Fence Houses ...	1 "	South Benwell Colliery ...	4 "	Weardale Coal and Iron Company ...	5 "
Monkwearmouth Colliery, Sunderland ...	1 "	St. Helens (Tindale) Colliery ...	1 "		

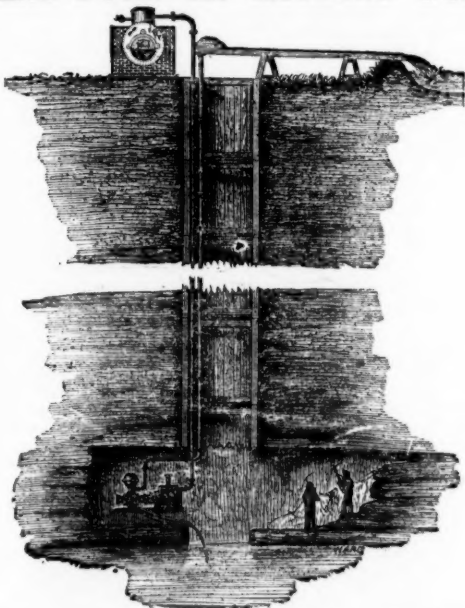
#### IRONWORKS AND ROLLING MILLS:—

Bede Metal Company, Jarrow ...	11 Pumps.	Gilkes, Wilson, Pease, and Co., Middlesboro' ...	2 Pumps.	Whitwell and Co., Stockton ...	3 Pumps
Bagnall, C. and T., Grosmont Ironworks ...	2 "	Lloyd and Co., Middlesborough ...	1 "	Whessoe Ironworks, Darlington ...	1 "
Consett Ironworks ...	2 "	Solway Hematite Iron Company, Maryport ...	1 "	West Cumberland Hematite Iron Company ...	1 "
Castleford Foundry Company, Normanton ...	1 "	Vaughan, Thomas, Middlesborough ...	2 "	Westbury Iron Company ...	1 "
Ellen Rolling Mills, Maryport ...	1 "	The Shotts Iron Company, Edinburgh ...	1 "		

#### THE "SPECIAL" STEAM PUMP AS APPLIED FOR DRAINING MINES.

The arrangement in the accompanying illustration shows an economical method of draining mines without the expense of erecting surface-engines, fixing pump-rods, or other gearing. A boiler adjacent to the pit's mouth is all that is necessary on the surface; from thence steam may readily be taken down, by means of a felted steam-pipe, to connect the pump with the boiler. The pump may be placed in any situation that may be convenient for working it, and connecting the steam, suction, and delivery pipes.

These engines can be fixed and set to work in a



comparatively short time, and also at a very small outlay. They are used in large mines as auxiliary engines, and will be found invaluable adjuncts in all mining operations.

To estimate the quantity of water to be raised by any given size of pump refer to the tabulated list below. It is recommended to use long-stroke pumps where the height exceeds 100 ft., so that the largest result may be obtained with a minimum wear and tear of the pump pistons and valves. The pumps are provided with doors for ready access to all working parts.

#### PRICES OF THE "SPECIAL" STEAM PUMPS.

Diameter of Steam Cylinder .....	2½	3	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12	12	14	16	26
Diameter of Water Cylinder .....	1½	1½	2	4	3	4	6	5	6	7	4	6	7	8	6	7	8	10	8	7	6½
Length of Stroke .....	6	9	9	12	12	12	12	12	12	12	12	12	12	18	12	12	18	24	48	24	72
Strokes per minute .....	100	100	70	50	50	50	50	50	50	50	50	50	50	35	50	50	35	—	—	—	—
Gallons per hour .....	310	680	815	3250	1830	3250	7330	5070	7330	9750	3250	7330	9750	13,000	7330	9750	13,000	—	—	—	—
PRICE .....	£10	£15	£20	£35	£30	£40	£47 10	£50	£52 10	£57 10	£50	£55	£65	£85	£70	£80	£100	—	—	—	—

IF BRASS LINED, OR SOLID BRASS OR GUN-METAL WATER CYLINDERS, WITH COPPER AIR VESSELS, EXTRA, ACCORDING TO SIZE.

Any Combination can be made between the Steam and Water Cylinders, provided the Lengths of Stroke are the same, thus—8 in. Steam and 3 in. Water, or 10 in. Steam and 3 in. Water, adapted to height of lift and pressure of steam, and so on.

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